Win-Win Supply Support

Distribution Network Alternatives for the Department of Veterans Affairs

VA201R1

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To support its 172 medical centers and outpatient clinics, the Department of Veterans Affairs spent nearly $1.3 billion in FY91 on drugs and pharmaceuticals, medical supplies, and nonperishable subsistence. In that year, the distribution system to deliver those items to the end users cost the VA $138 million, nearly $11 out of every $100 spent for medical material.

Much of the expense of the VA's material support system is caused by its large inventories, especially in the medical centers. Recent improvements by the VA (use of Prime Vendor distributors and faster service from the supply depots) have begun to reduce those inventories, but more can be done to reduce the system's costs and improve its responsiveness.

This report describes the current VA material distribution system and explains our approach, based on the identification of customer needs, for developing network alternatives. We define a composite measure of customer service, called average system response time (ASRT), and present six alternative material support strategies – each designed to satisfy ASRT – ranging from a consolidated "Super Depot" with regional distribution centers to total reliance on commercial sources. We then model four of those alternatives (and several variations of them) to determine their costs.

We recommend that the VA rely more on direct support, not inventories, to satisfy its medical material needs. To permit it to close the medical center warehouses, it should establish more direct support contracts and, in the short run, expedite all requisitions from its supply depots. It should establish 12 regional distribution centers to store the items that cannot be supported at reasonable costs under direct support arrangements. In the long run, the VA should phase out its depots.

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Executive Summary

WIN-WIN SUPPLY SUPPORT

Distribution Network Alternatives for the Department of Veterans Affairs

The Department of Veterans Affairs (VA) operates 172 medical centers and outpatient clinics, the largest single health care organization in the United States. In support of its mission to care for the nation's veterans and their families, the Department spent nearly $1.3 billion on drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items in FY91. In that year, the distribution network to deliver those products to its medical centers and clinics cost the VA $138 million, nearly $11 of every $100 it spent for medical material.

The VA supply network is designed around a traditional distribution process. It stores relatively large inventories (both in supply depots and the medical centers) to meet customers' needs and moves products in batches through various distribution channels. In response to customer demands for a more responsive supply system, the VA is testing a new distribution strategy – based on commercial distribution models – that is reducing inventories and improving response time. However, to significantly improve responsiveness and reduce distribution costs, it must change more aggressively.

The VA can implement one of several alternative distribution strategies to make further improvement. We describe them in detail in this report and show how much each will cost. Our conclusion is that the VA can satisfy its customers' needs at the optimum cost if it relies much more on direct support from vendors and much less on in-house inventories.

We recommend that the VA

- Set and agree on average response time standards for distributing drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items. For standards to be effective, the Office of Acquisition and Material Management (OA&MM), the Veterans Health Administration, and the

medical centers must agree on them. We offer a starting point by suggesting average response time standards for each commodity group.

- Use transportation and contracting strategies – not inventories – to meet response time standards at the optimum cost. In the past, the VA tried to minimize transportation costs through freight consolidation and that approach led to the need for large inventories at the medical centers. We found that network transportation costs are substantially less than the holding costs associated with those large inventories. Thus, VA can reduce overall distribution costs – and at the same time meet customers' needs better – by spending more on transportation.

- Rely on direct vendor support and reduce dependence on internal distribution channels. The VA should phase out the medical centers' costly "posted" stocks and the personnel and facilities necessary to maintain them; it should extend the Prime Vendor program now in effect for drugs and pharmaceuticals to all medical centers and should expand that program to include medical supplies and nonperishable subsistence items; it should have the depots make weekly deliveries of all commodities to their customers; and it should use regional distribution centers (RDCs). Finally, in the long run it should phase out the depots.

- Design the RDCs to serve a different function than the depots. The RDCs will be much smaller than the depots and will differ from them in three ways. First, the RDCs will provide single regional delivery points for vendors to use in cases when transportation and handling economics make direct delivery cost prohibitive. Second, RDCs will serve as alternative delivery points for contracts that require VA customers to order in minimum quantities, such as current contracts for dietary supplements, quantities for which the medical center has no storage space. Third, the RDCs will provide limited flexibility to stock items for which the VA cannot contract under direct support agreements at a minimum cost. Some items, mainly in the medical supply and nonperishable subsistence commodities, fall into this category. We have recommended locations for the RDCs and they include the locations of the current VA supply depots. For the current VA hospital system, we recommend 12 RDCs.

- Increase the use of national contracts with manufacturers and decrease local contracts. To do so the VA will need better negotiating skills, cost analysis capabilities, and contract administration expertise at the National Acquisition Center. And, as it increases its reliance on private-sector distribution channels, OA&MM must clearly communicate that strategy to its vendors.

- Establish distribution contracts on a regional basis. The VA's distribution regions should be carefully planned to coincide more closely with industry patterns than they did in early Prime Vendor contracts.

If the VA implements these recommendations, it will significantly reduce the cost and increase the responsiveness of its material distribution system. The system will be a modern one that relies on well-established private-sector capabilities. The VA will then also have the opportunity to streamline its internal distribution systems in the medical centers. Dramatic improvements are possible.

Lastly, we analyzed the opportunities for depot mechanization and the role of the Denver Distribution Center in the supply network. We do not recommend extensive mechanization either in the short term, where process improvements in the depots offer the most potential, or in the long term after the regional distribution centers have been activated. For the Denver Distribution Center, we do not believe that the benefit gained by relocating the center would outweigh the disruption caused by doing so. Management attention should be focused on implementing the new supply network and not on relocating the Denver Distribution Center.

CONTENTS

CONTENTS (Continued)

TABLES

FIGURES

CHAPTER 1

INTRODUCTION

BACKGROUND

The Department of Veterans Affairs (VA) operates a national health care network of 172 VA Medical Centers (VAMCs) that provide a full range of medical services to veterans and their families throughout the United States. The size, mission, and location of the VAMCs vary widely.

The medical centers are supported by a complex network of local VAMC warehouses, VA supply depots, external vendors (including both distributors and manufacturers), and other Government sources. In the VA's Central Office, the Office of Acquisition and Material Management (OA&MM) is responsible for the policy formulation, program direction, and centralized procurement of material to support the VA's physical distribution system, which includes three major supply depots and approximately 170 warehouses.

The VA spends about $2 billion a year for medical material. Each year the medical centers' customers generate requirements for material worth approximately $1.3 billion.[1] That expenditure is divided among drugs and pharmaceuticals (62 percent), medical supplies (34 percent), and nonperishable subsistence items (4 percent).

As reflected in Figure 1-1, the approximately $66 million of material inventories held at the VA supply depot level provide $288 million in material issues annually to either the VAMC warehouses or to medical center customers directly.[2] This represents 22 percent of total customer requirements. The level of VA supply

[1]Within the 172 individual medical centers, we define the customer as the service (pharmacy, radiology, dietetics, nursing, laboratory services, etc.) that relies on the supply network to provide medical material (drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items).

[2]The numbers in this report and those in our June 1992 interim report differ. Many of the figures in the interim report were based on VAMC survey data. Those figures were either validated or changed on the basis of actual depot data subsequently provided to us by the OA&MM staff. We believe the updated data are consistent with actual VA distribution activity.

depot support to customers varies somewhat by commodity – about 28 percent of drugs and pharmaceuticals, 10 percent of medical supplies, and 39 percent of non-perishable subsistence items comes from depot stocks. A portion of that material flows directly to the customers (51 percent, or $146 million) and the rest flows into VAMC warehouses (49 percent, or $142 million), again for ultimate issue to medical center customers.

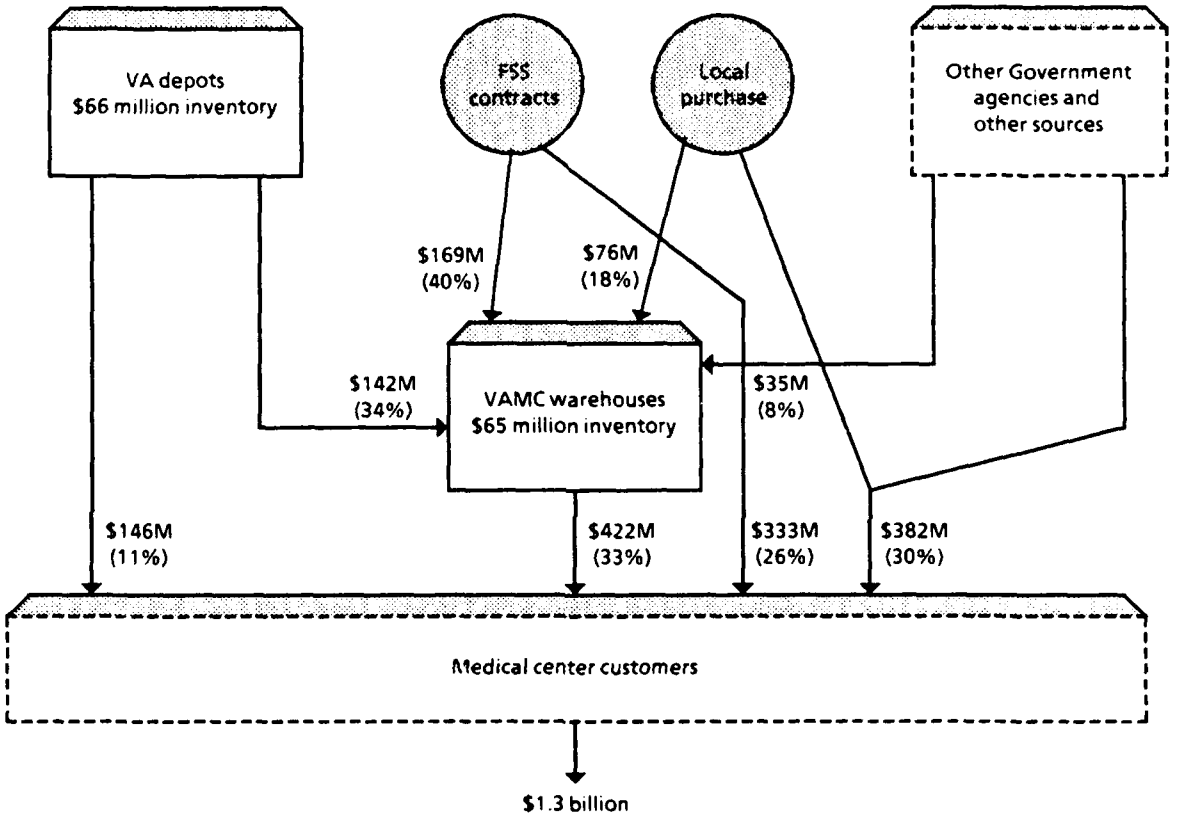


FIG. 1-1. OVERVIEW OF THE CURRENT DISTRIBUTION SYSTEM

The VAMC warehouse inventories ($65.2 million) represent about $422 million per year in issues to customers divided as follows:

- 34 percent ($142 million) came from the VA depots.
- 40 percent ($169 million) came from Federal Supply Schedule (FSS) purchases.
- 18 percent ($76 million) came from local purchases.

- 8 percent ($35 million) came from the Defense Logistics Agency (DLA), General Services Administration (GSA), and other Government sources.

Looking at the medical material sold to customers in FY91, we see the following:

- 33 percent ($422 million) came from VAMC warehouses.
- 11 percent ($146 million) was issued directly by the depot.
- 26 percent ($333 million) came from FSS purchases and was delivered directly to the customer.
- 30 percent ($382 million) came from local purchases by VAMCs, purchases from other Government agencies, and non-FSS purchases delivered directly to the customer.

VA MATERIAL SUPPORT CHALLENGES

The material support environment for VA health care is an extremely demanding one. Medical center customers (pharmacy, radiology, etc.) demand high-quality drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items, and expect them to be delivered responsively and reliably at a reasonable cost. Because those customers have several sources of supply (local purchase, FSS, centralized direct vendor support, VAMC warehouse support, and depot support), demand management and integrated inventory positioning within the VA material management system are difficult to achieve.

Very short product development cycles, particularly in the area of drugs and pharmaceuticals, mean that the inventory stocked in VA depots and VAMC warehouses is extremely dynamic. Moreover, advances in health care procedures and policies continually affect customer service requirements and emphasis. Further, technological advances in information processing and communications are opening up new opportunities in material management strategies, policies, and systems, and the clear trend in the health care industry is toward direct support arrangements with manufacturers or distributors, particularly for drugs and pharmaceuticals. In the private sector there has been a general trend toward direct support principles in network design and management. For example, companies such as Baxter Healthcare Corporation (through its Value Link system) have had great success in linking the customer more directly with manufacturers or distributors and in eliminating material inventories.

Because of the demands of the VA health care environment and the changing mix of strategies and approaches available to material managers today, the Department seeks an innovative material management strategy to satisfy customer needs at the lowest total cost by using the most effective mix of internal VA, other government agencies (OGA), and external distribution sources. The emerging role for VA supply depots must be carefully formulated as a part of this overall VA material management strategy.

OBJECTIVES AND SCOPE

Objectives

This report examines the distribution strategies, network structure, and mechanization capabilities used to provide medical material to the medical center customer. It also addresses the Denver Distribution Center (which supplies hearing aids, prosthetic and sensory aid supplies, and related devices) and its role and placement within the VA distribution system.

Overall, the VA has four major objectives in reexamining its distribution strategies:

- To develop a cost-effective VA distribution strategy that meets the needs of its medical center customers. This strategy includes the following:
  - Sourcing
  - Material positioning
  - Related performance standards.
- To select a network alternative that supports the VA distribution strategies and best satisfies their cost/service standards. The network alternative will include the following:
  - Function of each distribution point within the network
  - Number and location of distribution points
  - Size and workload projections of distribution points
  - Distribution point operating costs and staffing requirements
  - Transition issues.

- To propose mechanization alternatives that will enable the VA to streamline its supply depot operations under the strategies and network alternative recommended.
- To evaluate the role of the Denver Distribution Center and recommend its place in the distribution network.

We produced an interim report in June 1992 to satisfy the following limited objectives:

- To establish a clear definition of VAMC customer requirements to provide a foundation for formulation of future distribution strategies
- To identify and discuss a range of alternative distribution strategies for further analysis
- To recommend a limited number of these alternative distribution strategies for detailed modeling and analysis.

The June 1992 interim report forms the basis for the first two chapters of this report. Its discussion of alternative strategies is contained in Appendix A.

Commodities Reviewed

For purposes of this report, the commodity groups examined were limited to three general categories:

- Drugs and pharmaceuticals
- Medical supplies
- Nonperishable subsistence items.

In our analysis, we maintain these commodity distinctions in recognition of the fact that each commodity has differing support requirements, cost-volume relationships, handling and transportation economics, and external sourcing and distribution alternatives. Our report does not address other subsistence items, equipment, services, facilities maintenance, and the myriad other support requirements that comprise total medical center material support.

Organizations Reviewed

For purposes of our discussion throughout this report, we consider the VA distribution system to include VAMC warehouses, VA supply depots, and external material sources. As such, it does not include any other material distribution organi-

zations within the VA. Furthermore, in our analysis, we have not included VAMC customer-level inventories, management practices, inventory positioning decisions, service organization and staffing, service-level ordering, financial management, and control procedures. We have defined those organizations – the VAMC services – as the customers and do not consider them a part of the VA distribution system for this analysis. Indeed, this report by design does not directly address ways to improve material management at the medical center customer level and below. In evaluating the proposals advanced in this report, we assumed that existing policies and practices on material management, stockage, ordering, and organization at the medical-center-customer level and below will remain essentially as they are today with the sole exception that those customers will likely be operating under new external support arrangements and sources for selected material requirements.[3]

Baseline Data Sources

Major data sources for this report included interviews and on-site visits, survey/questionnaire responses from the medical centers, and data extracts from VA depot material management system files. Specific organizations visited, detailed survey documents, and specific baseline summaries were provided in our June 1992 interim report. Unless we indicate otherwise, our estimates are based on FY91 data.

REPORT FORMAT

This report includes the results of our analysis and our recommendations for the distribution of material to VAMCs. In Chapter 2, we discuss customer requirements and alternative material management strategies that we analyzed. We highlight those organizations surveyed in our field visits, present our analysis of current VA material management policies and practices, and present selected baseline operating

[3]The reality of material management in private health care systems today is that effective cost control mandates a reduction in the level of material inventories that have traditionally been a part of the distribution system, including inventories on the hospital itself. Our discussions with many logistics professionals in the private sector indicate that roughly 50 percent to 60 percent of total material distribution costs are incurred within the hospital, with a substantial portion of that total incurred within the using service, ward, etc. Thus, we anticipate that the VA will ultimately move to address material management organizations, policies, and systems at the service level and below. However, such an initiative (and the associated implications of reduced service-level inventories) should be based on full confidence in a proven external distribution support system, a system that has itself been streamlined and improved. As a result, our approach and recommendations are designed to improve this external distribution system as an essential prerequisite to future service-level inventory reductions.

measures. We specifically define, illustrate, and quantify (as a baseline requirement) our aggregate service measure [average system response time (ASRT)] for each commodity group. The ASRT was used as a constraint in our modeling efforts; that is, all of the alternatives that we modeled were specifically designed to meet ASRT standards presented in Chapter 2. Finally, we identify those critical material management strategies and distribution network design principles that guided our further evaluation of specific network alternatives.

In Chapter 3, we describe the alternatives that we tested with our network model and how we modeled them. We present our findings and discuss their sensitivity to price premiums. Included in Chapter 3 is a discussion of two additional alternatives proposed to us by OA&MM after we briefed our findings. Finally, we present our conclusions from the modeling effort.

Chapter 4 contains our conclusions and recommendations. We recommend a specific material support strategy for the VA and discuss how the transition to the new strategy can be made.

The last chapter, Chapter 5, discusses mechanization alternatives for the depots in the short term and for the new network in the long term. It also presents our recommendations concerning the Denver Distribution Center.

This report is supplemented by seven appendices designed to provide depth and detail in selected areas. Appendix A provides a complete discussion of the methodology we used in the report and supplements the discussion in Chapter 2. Appendix B presents a series of significant network design trends upon which our analysis was based. Appendix C contains material from the June 1992 interim report describing and analyzing six alternative material support strategies. Appendix D describes the data used in our modeling effort and where we obtained it. Appendix E contains the detailed output from the model, showing the transaction volumes, facility and personnel requirements, and expected cost of each alternative. The appendix has detailed cost information by commodity and channel for every alternative we modeled. Appendix F shows the locations of facilities for the alternatives we modeled and their distances from the medical centers they would support. Finally, Appendix G contains our letter report to OA&MM on depot mechanization.

CHAPTER 2

APPROACH, BASELINE, AND NETWORK ALTERNATIVES

INTRODUCTION

In this chapter, we discuss the approach used to develop and analyze the specific VA distribution network alternatives presented in this report. We describe the baseline VA distribution network and discuss network alternatives. We present our assumptions and the methods we used to formulate and analyze alternatives to VA's current material distribution system.

Our approach to developing the distribution network alternatives consisted of the following actions:

- We interviewed the VAMC customers to develop an understanding of their specific material support needs.
- We then examined current VA material management policies to identify key business rules, information systems, and operating procedures.
- We analyzed current VA material management performance indicators for both cost and service to establish a baseline for comparative analysis.
- Where performance standards did not exist, we established them on the basis of our interviews with customers.
- We formulated a set of integrated distribution strategies designed to focus VA distribution capabilities on key customer requirements and to take advantage of emerging management and technological concepts.
- Finally, we identified a series of specific distribution network alternatives that appear to offer cost or service improvements relative to the current VA distribution network.

In the following sections, we discuss those steps and present our conclusions. Our approach is discussed in greater detail in Appendix A.

CUSTOMER FOCUS

Network design must begin with the customer, and we define the customer as the using service within a VAMC that relies on the VA material distribution system

for support. Under that definition, the customer is clearly not a part of the distribution system, which begins with the Chief of Acquisition and Material Management at the VAMC (and the VAMC warehouse) and extends through the depot level – and ultimately to external vendors.

Customers generally express their needs as specific system requirements or capabilities. Such factors may include the following:

- Cost
- Quality
- Dependability and availability
- Flexibility and responsiveness.

While the relative importance of these separate factors may differ by VA customer, a limited number of service or cost factors are typically of greatest importance to a majority of customers. In "customer-driven" distribution networks, customer service requirements – not distribution costs alone – dictate network design. Distribution costs (which include fixed facility costs, operating costs, inventory acquisition and investment costs, and transportation costs) are relevant only in the context of a service-level objective. Therefore, to develop the most appropriate VA distribution network, we first identified those specific factors that are important to customers. Only then could we address the specific issues generally associated with network design (including the number, size, mission, location, and interrelationships of fixed facilities such as warehouses, consolidation centers, and transportation hubs; the sourcing, positioning, and service/cost objectives of material inventories; and the role, modal choice, and sourcing or development of transportation services).

We visited 12 VAMCs in various parts of the United States (Table 2-1). At those centers, we talked to customers in pharmacy, dietetics, laboratory services, nursing, and radiology. We conducted detailed interviews with user services at each medical center visited. We specifically asked customers about their service requirements – delivery reliability, ease of doing business with the material distribution system, and product quality – and the importance of costs relative to delivery responsiveness. In selected cases, we attempted to validate or confirm these customer perspectives in interviews with senior VAMC administrators. Not surprisingly, different customers had different views on their service requirements and on the importance of cost in the mix. However, in the course of our interviews of over

100 individuals, a consistent picture of medical center customer requirements began to emerge. Table 2-2 provides ranked results based on our customer interviews.

TABLE 2-1

VAMCs VISITED

VAMC	Services interviewed
Hines, Ill.	Pharmacy, dietetics, nursing, SPD, radiology, laboratory services
North Chicago, Ill.	Pharmacy, dietetics, nursing, SPD, radiology, laboratory services
Long Beach, Cal.	Pharmacy, dietetics, radiology, SPD, laboratory services
Sepulveda, Cal.	Pharmacy, dietetics, nursing, SPD
Lyons, N.J.	Pharmacy, dietetics, laboratory services, SPD
Richmond, Va.	Pharmacy, dietetics
Baltimore, Md.	Pharmacy, dietetics, radiology, laboratory services
Nashville, Tenn.	Pharmacy, dietetics, SPD, radiology, laboratory services
Murfreesboro, Tenn.	Pharmacy, dietetics, SPD
Palo Alto, Cal.	Pharmacy, dietetics, SPD, radiology, laboratory services
Livermore, Cal.	Pharmacy, dietetics, SPD, radiology, laboratory services
Dallas, Tex.	Pharmacy, SPD

Note: SPD = supply processing and distribution.

TABLE 2-2

VAMC CUSTOMER REQUIREMENTS

Service factor	Pharmacy	Dietetics	Nursing	Radiology	Lab
Responsiveness of delivery	1	2	1	1	1
Reliability of delivery	2	1	2	2	2
Ability to place emergency (same day) orders	3	6	4	5	5
Total ease of doing business (ordering, processing financial transaction, etc.)	4	3	5	3	3
Cost of material	6	5	6	6	6
Quality of material	5	4	3	4	4

Note: Ranking as most important = 1, least important = 6.

The customers clearly indicated that what is most important to them is responsiveness, reliability, ease of doing business, and quality rather than material cost. [In a typical VAMC, material costs (excluding major equipment and services) represent only about 20 percent of medical center operating costs. They are not an overriding consideration to those VAMC administrators and service customers we interviewed.] The focus of the medical center is on capable, responsive, high-quality medical service.

Using the customer ranking from Table 2-2, we ranked the service factors by level of importance to medical center customers as follows:

Service factor	Mean rank
Delivery responsiveness	1.2
Delivery reliability	1.8
Ease of doing business	3.6
Quality	4.0
Emergency orders	4.6
Cost	5.8

Customers made it clear that responsive, dependable, and flexible material support (within reasonable cost bounds) from the VA distribution system is a viable customer service objective. This customer input forms the foundation for our subsequent discussion of ASRT requirements, composite network design and performance evaluation measures that capture both delivery responsiveness and delivery reliability.

MATERIAL MANAGEMENT POLICIES

With an understanding of customers' service objectives, we examined the VA's current policies for material management. Material management policies determine those overall management approaches and principles that will ultimately guide the operation of the material management system. We have segmented and defined VA material management policies in the following areas:

- Material sourcing
- Material positioning

- Material ordering
- Material funding.

To develop an understanding of current VA material management policies, procedures, systems, and performance we used a survey to collect a wide range of information. In addition, we visited the following organizations:

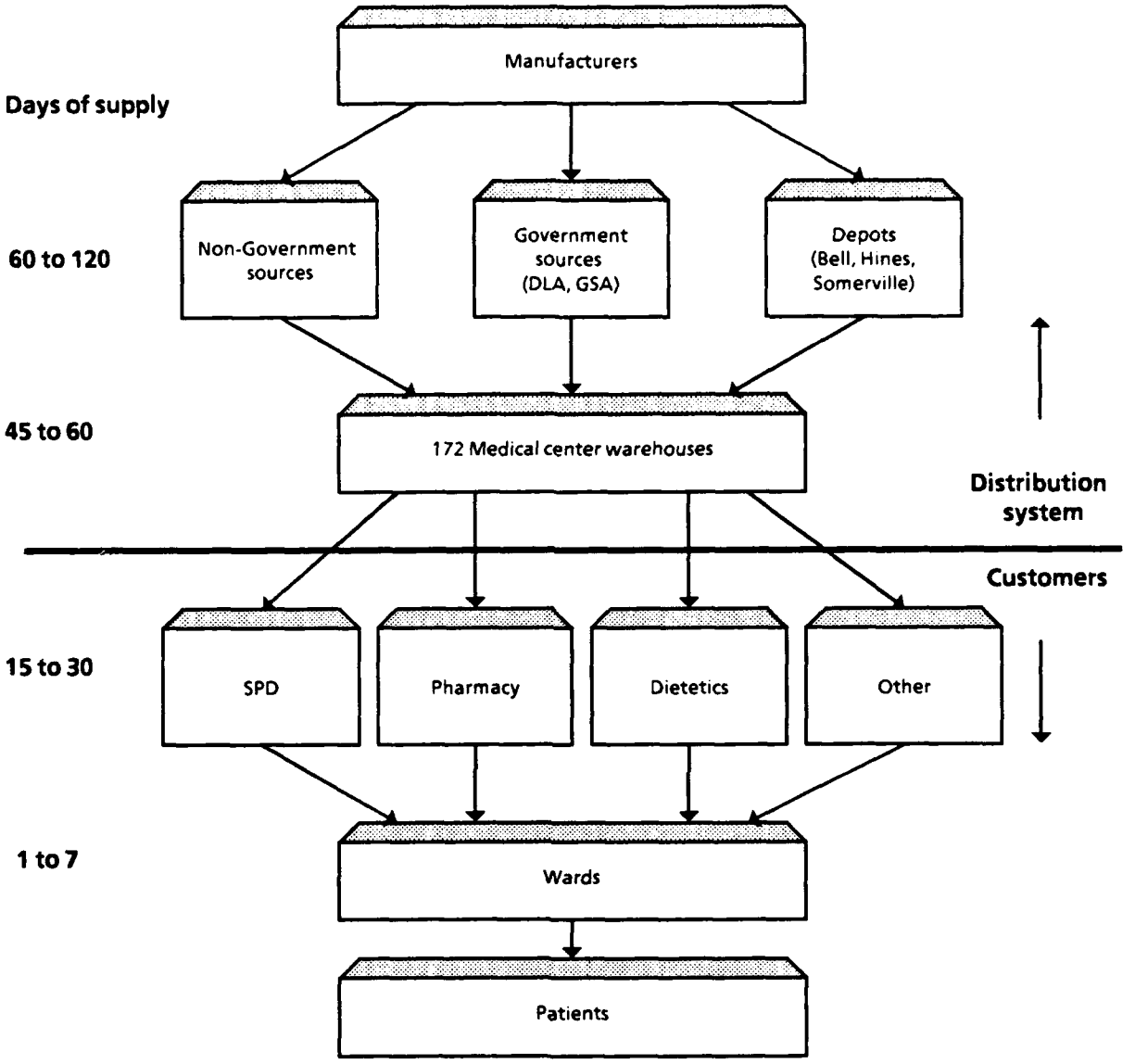
- The VA supply depots in Hines, Ill.; Bell, Cal.; and Somerville, N.J.
- The National Acquisition Center (NAC) in Hines
- Acquisition and Material Management (A&MM) services at the 12 VAMCs visited.

Figure 2-1 is a diagrammatic overview of the current VA material distribution system. It indicates the interface of the distribution system (as we have defined it) and the customers in the VAMC. Using that diagram as a guide, we discuss current VA material management policies and procedures used to support the VAMC customers.

Material Sourcing

The VA's material sourcing strategies call for using a wide variety of potential sources for all three supply commodities: drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items. Sources vary by commodity, level of usage in terms of units demanded and dollar value, contractual vehicles used for ordering, and cost of the material under different alternatives. From our analysis of medical center survey responses and as reflected in Figures 2-2 and 2-3, major sourcing alternatives include:

- *Direct support to medical center customers* – Direct support is provided to using services under a variety of contractual/support arrangements including local purchase, FSS – and for selected drugs and pharmaceuticals – Prime Vendor contracts. In general, the VA is moving toward more use of direct support sourcing arrangements (as are other health care organizations). As shown in Figure 2-2, the baseline data provided by VAMCs indicate that local sources (34 percent of VAMC expenditures) and FSS, direct support, and other nondepot sources (33 percent) are already major supply sources for medical center customers. The amount of direct support varies by commodity as shown in Figure 2-3. Based on dollar value,

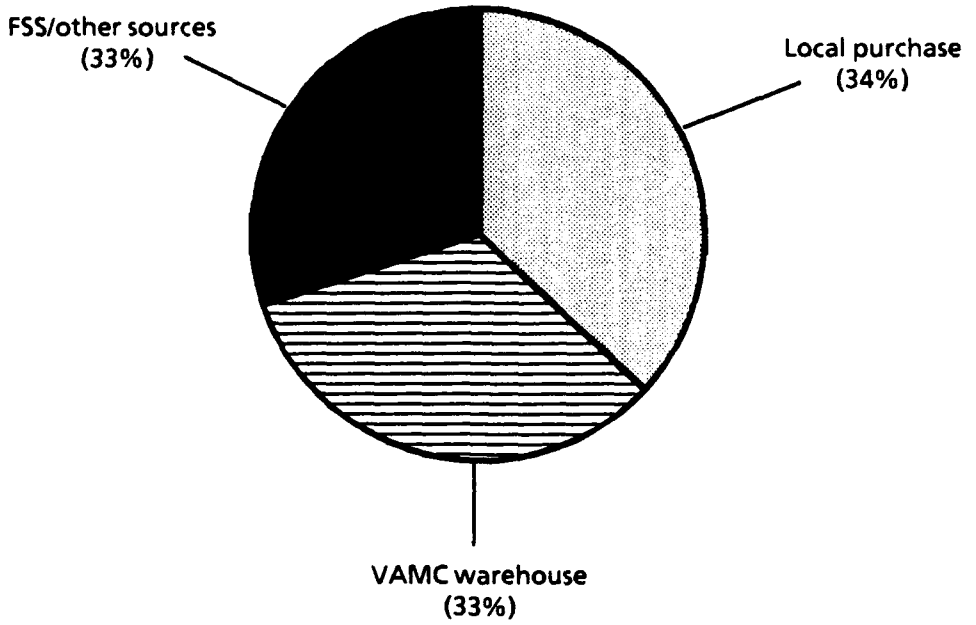


Note: Some levels skipped for certain items.

FIG. 2-1. CURRENT VA DISTRIBUTION ORGANIZATION

we estimate that once Prime Vendor contracts[1] are implemented system-wide, approximately 75 percent of total drugs and pharmaceuticals, 60 percent of medical supplies, and 10 percent of nonperishable subsistence items will be delivered directly to the VAMC customer under some form of direct support arrangement.

[1]Prime Vendor is an on-demand, on-line ordering system available at some VAMCs to enable them to order a predefined range of drugs and pharmaceuticals and have them delivered directly from specified distributors within 1 day. These orders by-pass the VAMC warehouse and the VA depot.



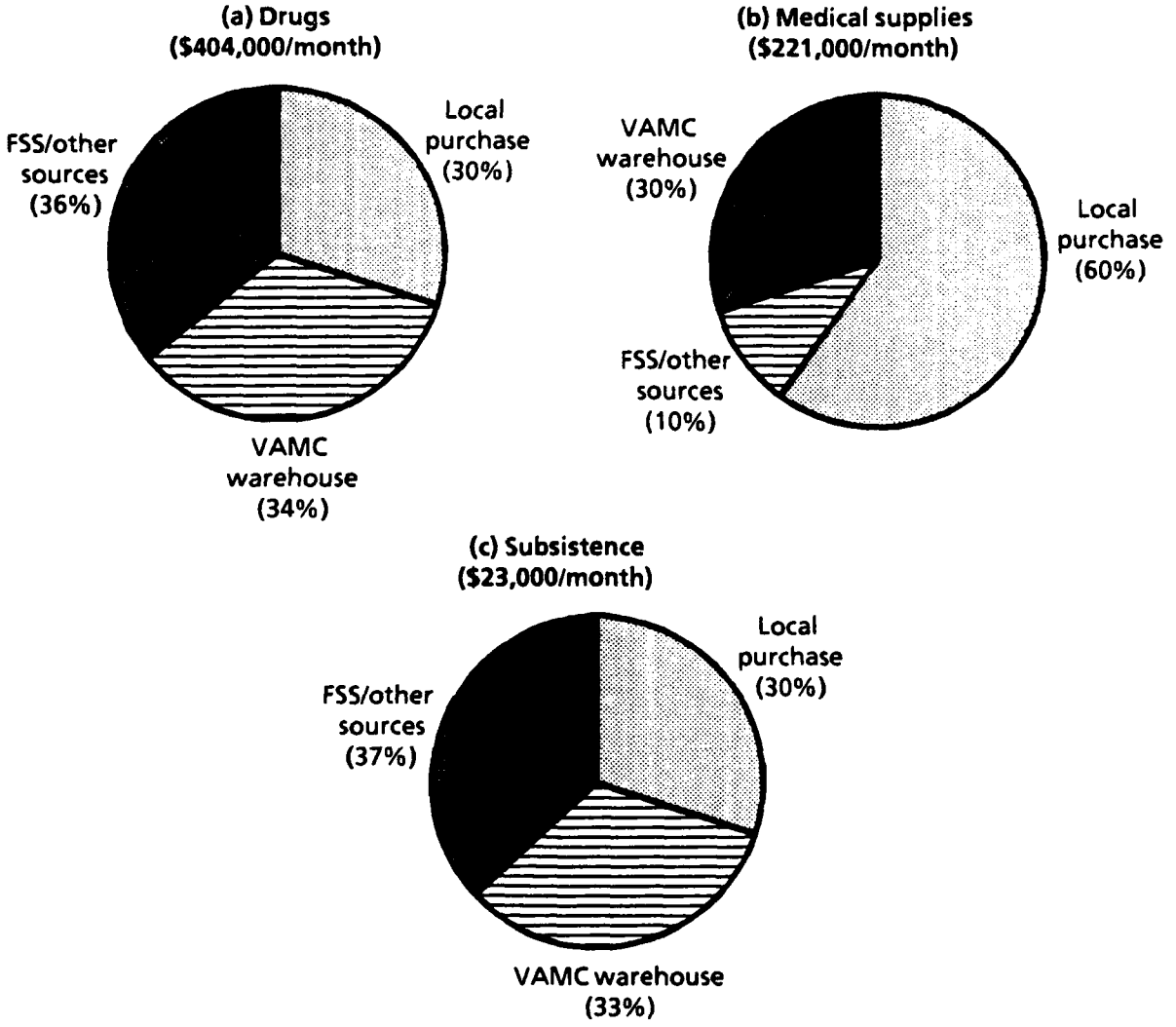
Source: VAMC surveys.
Note: Based on average monthly expenditures of $648,000.

FIG. 2-2. TOTAL VAMC SOURCES (IN PERCENTAGE OF VAMC EXPENDITURES)

- *VAMC warehouse support to medical center customers* – VAMC warehouses have traditionally provided direct material support to customers for most of the commodities included in this study. Over time, the role of the VAMC warehouse has been redefined and has become somewhat more limited. Today, however, it continues to serve as the primary source for many drugs and pharmaceuticals, some medical supplies, and much subsistence, including most nonperishable subsistence items. VAMC warehouse issues now account for 33 percent of total customer requirements. The current warehouse sourcing collected as baseline data from the VAMCs is shown in Figure 2-3. We estimate that when Prime Vendor and USXPRESS[2] are fully implemented, approximately 5 percent of drugs and pharmaceuticals, 30 percent of medical supplies, and 55 percent of nonperishable subsistence items will be provided to the medical center customer from the VAMC warehouse inventory.

- *VA depot support to medical center customers* – Under the USXPRESS initiative, VA supply depots directly support customers for selected drugs and pharmaceuticals at specific medical centers (the material does not pass through the VAMC warehouses). In addition, a limited number of medical

[2]USXPRESS is an on-demand, on-line ordering system available at some VAMCS to enable them to order drugs and pharmaceuticals from VA depots and have them delivered directly within 72 hours.



Source: VAMC surveys.
Note: Based on average monthly expenditures of $648,000.

FIG. 2-3. VAMC SOURCING BY COMMODITY (IN PERCENTAGE OF VAMC EXPENDITURES)

supply items not stocked at the VAMC warehouse are available from the VA depot. Based on survey data, total direct support from VA depots to customers is currently about 11 percent of total VAMC receipts. We estimate that when Prime Vendor contracting and USXPRESS are fully implemented, 20 percent of drugs and pharmaceuticals, 10 percent of medical supplies, and 35 percent of nonperishable subsistence items will be delivered directly to the medical center customer from the VA depot.

Material Positioning

The current VA distribution system is a two-level system with material placed at VAMC warehouses and at VA supply depots. Our baseline analysis shows that the current distribution system is inventory-intense; approximately 60 to 120 days of inventory is held at the depot level, and an additional 45 to 60 days of inventory is held in the VAMC warehouse. The typical VAMC stocks about 475 line items valued at approximately $384,000. In total, the current internal VA distribution system holds between 3.5 and 7.5 months of inventory of selected items to support the VAMC customer.

Material is selected for stockage on the basis of its frequency of use (the number of demands) and the dollar value of usage (the dollar value of demands). At the VAMC warehouse level, published stockage criteria in VA Manual MP-2 require a minimum demand frequency of 12 requests a year and a projected usage of at least $500 per year, or a minimum demand frequency of at least 8 requests a year and a minimum usage of $2,000 per year. These criteria are generally recognized at the VAMC level, but we found some variation in application based on local space constraints and medical center priorities.

At the depot level, the criteria for stockage are less clear and appear to have varied over time. At one point, items were qualified for stockage in the depot system if their minimum demand frequency was 25 orders a year and they had a minimum projected usage of $2,500 a year. Current VA depot stockage criteria used at the NAC are a minimum demand frequency of 20 orders and a minimum potential cost avoidance of $7,500 a year.

The depth of inventory held in the depots or warehouses at any one time varies by item based on the level of demand, the commodity, and the ordering policies used. Table 2-3 provides summary inventory data for both VA depots and VAMC warehouses.

At the depots, drugs and pharmaceuticals represent 63 percent of the dollar value of inventories, while general and medical supplies (19 percent) and non-perishable subsistence items (18 percent) make up far smaller elements of the total depot inventory investment as shown in Table 2-3. In VAMC warehouses, drugs and pharmaceuticals currently represent about 62 percent of the dollar value of inventory and about 64 percent of the dollar value of issues. This warehouse inventory of drugs

TABLE 2-3

AVERAGE FY91 INVENTORY POSITIONING DATA

Inventory	Drugs and pharmaceuticals	General and medical supplies	Nonperishable subsistence items
VA depots			
On hand ($ millions)	41.4	12.8	12.0
Monthly issues ($ millions)	19.5	4.5	3.0
On hand (days)	64	85	120
VAMC warehouse			
On hand ($ millions)	40.1	20.9	3.9
Monthly issues ($ millions)	25.2	12.0	2.3
On hand (days)	48	54	57

Source: VAMC survey and VA depot survey results; data reflect FY91 averages.
Note: All values are FY91 dollars.

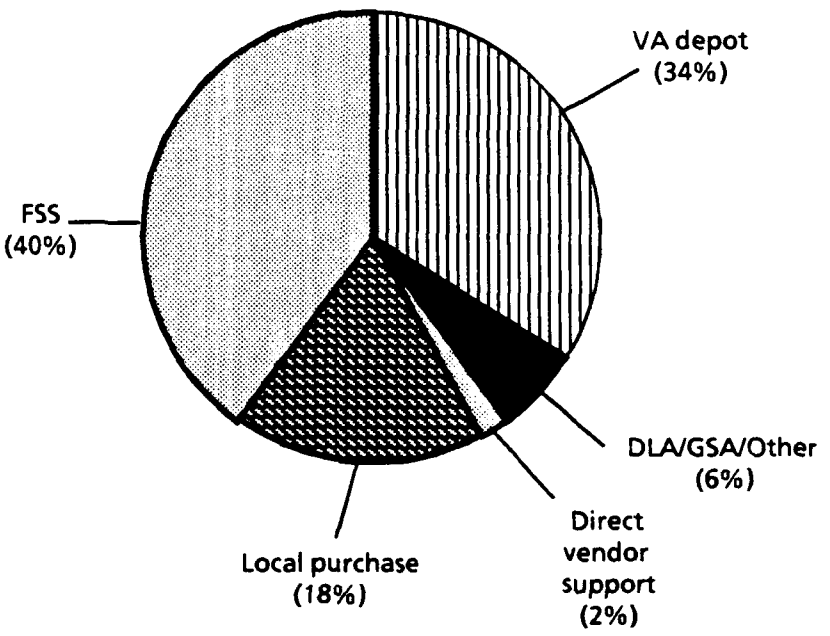
and pharmaceuticals can be expected to fall with full, systemwide implementation of Prime Vendor contracting and USXPRESS. Comparable data for medical supplies and nonperishable subsistence items are 32 percent of inventory and 30 percent of issues and 6 percent of inventory and 6 percent of issues, respectively.

The VAMC warehouses replenish their stocks from the VA depots, FSS vendors, local purchase vendors, and OGAs such as DLA and GSA. Figure 2-4 gives a breakdown of the sources of VAMC warehouse replenishments based on dollar value by source for the commodity groups of interest compiled from data submitted by the VAMCs.

Material Ordering

The VAMC customers order material under a variety of policies, procedures, and systems:

- *Prime Vendor*
- *USXPRESS*



Note: Based on issues of $218,000/month.

FIG. 2-4. VAMC WAREHOUSE SOURCES (IN PERCENTAGE OF WAREHOUSE ISSUES)

- *Local purchase and FSS* – For "nonposted" FSS and non-FSS items (not stocked in the VAMC warehouse), these on-demand orders are processed through the VAMC A&MM service. Delivery times vary from a week to a month or more based on the contracting method and material availability from vendors. VAMC survey data indicate a mean delivery time for local purchase of 21.4 days and a mean delivery time from other nondepot sources of 25.6 days.

- *VAMC warehouse orders* – Processed under internal automated or manual order-book procedures on an established order/delivery schedule designed to smooth medical center warehouse issue-and-delivery workload, these orders are transmitted to A&MM for VAMC warehouse processing. Typical order cycles are as follows: drugs and pharmaceuticals, weekly or biweekly; medical supplies, biweekly or monthly; and nonperishable subsistence items, weekly. Orders are typically delivered within 3 to 5 days, based on VAMC survey data.

Material Funding

All material inventories held either in the medical center warehouses or in VA depots are funded with VA Supply Fund dollars under established supply fund procedures. VA depot operations and transportation costs associated with moving

material to and from the VA depots are also captured as a part of supply fund expenses and are allocated to customers through surcharges. For VAMC warehouse operations (including local delivery of material to the VAMC customer), operating costs are funded through appropriated funds that are budgeted and administered by the medical center.

BASELINE ASSESSMENT

Our analysis indicates that the current VA material management system, including the existing distribution network, is generally responsive to VAMC customers. At the same time, we believe the existing system is extremely cumbersome and complex, often frustrating to customers, and very inventory-intense. Transaction costs to the customer are particularly oppressive; those costs accrue because material is received from many different sources under varying ordering agreements. Furthermore, customers find it tedious to interact with the VA financial system. Finally, order status given to the customer is often inaccurate or not available and local purchase interfaces are typically burdensome.

From information collected in the VA data call and information provided locally during site visits, we were able to estimate a baseline ASRT by commodity group. The estimates are shown in Table 2-4.

TABLE 2-4

COMPONENTS OF BASELINE ASRT PERFORMANCE AFTER FULL IMPLEMENTATION OF PRIME VENDOR CONTRACTING AND USXPRESS

Source	VAMC warehouse	Local purchase (non-FSS)	Local purchase (FSS)	Prime vendor	USXPRESS	VA Depot	Baseline ASRT
Drugs and pharmaceuticals	@ 72 hours 5%	@ 480 hours 15%	@ 240 hours 30%	@ 24 hours 30%	@ 72 hours 20%	NA	170 hours
Medical supplies	@ 120 hours 30%	@ 480 hours 40%	@ 240 hours 20%	NA	NA	@ 360 hours 10%	312 hours
Nonperishable subsistence	@ 192 hours 85%	@ 480 hours 10%	NA	NA	NA	@ 360 hours 5%	229 hours

Source: VAMC survey, VAMC on-site Interviews, and depot material management extracts.
Note: Also shown are the percentages of each commodity filled by the various sources.

We selected ASRT as the aggregate composite measure of customer service most appropriate to VAMC using services. As such, we defined it as follows:

> Average system response time is the average or anticipated delay in hours or days that should be expected by the VAMC customer from the time a replenishment order for service-level stock is placed until the material is delivered to the service, without regard to the source of the material.

We used ASRT to represent the responsiveness goal or target to develop VA material management strategies and, as a constraint, to evaluate alternative distribution networks. It thus represents the key linkage between the customer in the VAMC and the VA distribution system. It serves as both a customer-service-level requirement (specified by the customer) and as a performance target (from the perspective of the VA distribution system). Therefore, any realistic effort to model and improve the VA distribution system structure must be "operationally grounded" on a mutually agreeable ASRT standard. The ASRT standard or goal must be understood and accepted by both the VAMC customer and the Veterans Health Administration (VHA)[3] and by acquisition and material management personnel in the field and central office. ASRT is explained in detail in Appendix A.

The ASRT is quantified in hours. Those hours are the summation of expected order/delivery time to the VAMC customers from each source weighted by the percentage of VAMC customer requirements filled by that source. Table 2-4 shows the current ASRT baseline, with the various commodities being provided to VAMC customers according to the current sourcing alternatives discussed earlier. However, for drugs and pharmaceuticals, the data assume full implementation of Prime Vendor contracting and USXPRESS initiatives at all VAMCs.

Table 2-5 is a summary of Table 2-4, showing an overall baseline ASRT figure for routine stock replenishments of each commodity. It also includes (for comparison and developing a basis for modeling) proposed ASRT standards based on customer expectations.

The ASRT baseline reflects the way business is currently being done and should not be confused with customer expectations. For example, in the pharmacies we visited that have implemented Prime Vendor and USXPRESS, we found that weekly

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[3]The VHA is the component of the VA that operates its medical centers. The VHA staff comprises the care providers and support staffs in the VAMCs and their management at VA's central office.

TABLE 2-5

CURRENT VA ASRT PERFORMANCE AND PROPOSED ASRT STANDARDS

Commodity category	Baseline ASRT	Proposed ASRT standards
Drugs and pharmaceuticals	170 hours (about 7 days)	120 hours (5 days)
Medical supplies	312 hours (13 days)	240 hours (10 days)
Nonperishable subsistence items	229 hours (about 10 days)	168 hours (7 days)

order cycles and weekly deliveries were common. We calculated the ASRT for drugs and pharmaceuticals at 170 hours, about 7 days. The current system in those pharmacies has service-level inventories that are large enough to accommodate that ASRT so pharmacists do not run out of supplies, but they told us they wanted more responsive service. Similarly, the baseline's ASRT for medical supplies (312 hours) and nonperishable subsistence items (229 hours) reflect the current 1.5-to-2 week order cycle for replenishment of service-level inventories that were common to the medical centers we visited. These baseline ASRT values denote today's reality, not necessarily the desires customers expressed in our on-site interviews. In general, customers seek a more responsive distribution system and shorter ASRTs.

The proposed ASRT standards shown in Table 2-5 are based on the VAMC customer expectations identified in our site interviews and reflect the general service requirements of the customers we interviewed. They are best seen as "compromise numbers" in that they represent what most people interviewed agreed were reasonable targets. Some individuals desired more responsive, shorter ASRT standards, while others indicated that they would accept less responsive, longer ASRT goals. In all commodity groups, an improvement of approximately 30 percent in the baseline ASRT levels will be required to meet customer expectations.[4] We consider this service improvement mandatory to future VAMC operations, and we used the ASRT standards as constraints in modeling of specific distribution alternatives. All

[4]The proposed standards are an improvement of approximately 29 percent over current Prime Vendor/USXPRESS support levels for drugs and pharmaceuticals, 23 percent over current ASRT for medical supplies, and 30 percent over that for nonperishable subsistence items.

alternative distribution systems that we proposed were evaluated on their ability to meet these ASRT standards.

Customers, particularly pharmacists, were consistent in their desire for improved reliability and responsiveness. From their perspective, a dependable ASRT of 5 to 10 days would allow them to operate more efficiently in the service by being able to manage the workload of ordering and receiving material, reduce waste and time spent managing shelf-life items, and live within existing storage space and staffing constraints. It would also allow them to reduce service-level inventories.

We used the same proposed ASRT standards for all medical centers. Using such systemwide standards ensures a common level of service to all medical centers and allows uniformity in service-level material management policies and procedures. Some of the more remote medical centers will incur higher costs (primarily for transportation), and it can be argued that the tradeoff between those costs and the cost of additional inventory under a less responsive standard might make relaxed standards for remote locations more cost-effective. We believe that those specific cases should be addressed only after the basic VA material distribution strategy and network have been defined.

DISTRIBUTION NETWORK DESIGN PRINCIPLES

In developing specific distribution alternatives, we must consider the broad strategic changes that are taking place today in material distribution as well as the distribution strategies that appear to be unique to the health care industry. Regardless of the specific characteristics of a given distribution network, we believe that the design of tomorrow's VA distribution network should be based on the following concepts:

- *Let service and cost factors dictate the specific design of the network* – In network design efforts, let specific service requirements and network costs determine the structure of the distribution network, including the type, mission, number, and location of distribution facilities rather than initially assuming some predetermined network approach.

- *Define network costs broadly and comprehensively* – Consider the full range of distribution costs in network modeling efforts including the costs of holding material inventories; the costs of transportation into, within, and from the distribution system; facility operations costs; and the transaction

costs (ease of ordering, ability to get order status, etc.) associated with the customer "doing business" with the distribution network.

- *Define network service requirements narrowly and specifically* – Network design should ideally be based on a clear, measurable service standard (or a set of standards covering different commodities), and that standard should be specifically tailored to the needs and expectations of the customer. Further, the standard should be specifically defined (i.e., quantified) and should be formally reviewed and approved by the customer prior to network development.

- *Hold material inventories as far up in the network as possible* – All else being equal, distribution network design should be oriented to positioning material inventories as close to the source as cost and service factors will allow; that means that when cost and service factors allow, direct vendor support alternatives are preferred to central depot stockage; central depot stockage is preferred to regional depot stockage; and regional depot stockage is preferred to local VAMC stockage.

- *Maximize asset productivity* – Given an overall service target or goal, specific distribution network design should be dedicated primarily by the need to maximize the use or productivity of the assets (such as people, transportation resources, inventories, facilities, etc.) that make up the system relative to network costs.

- *Substitute information for other logistics resources (such as inventories, people, facilities, etc.) wherever possible* – Aggressive application of available communications and management information system technologies should be incorporated into network design planning to minimize total distribution costs.

- *Manage the network horizontally, not vertically, by focusing on flows rather than functions* – The distribution network should be viewed as an integrated system of material, information, and financial flows. Viewed in that context, the composite performance of the entire distribution network is important, not merely the individual performance of any single function, organization, or facility within the network.

- *Establish long-term alliances with vendors and carriers wherever appropriate to share risk and reduce uncertainty* – Increasingly, distribution network design is based on the development and use of continuing external value-added relationships with key vendors and carriers who serve the network. These "partners," who are typically far more efficient in their specific areas of expertise than the overall network manager, must have access to planning and operational data to reduce uncertainty and to provide desired services at reasonable costs.

- *Exploit volume material acquisition, storage, and movement* – Network development planning should be sensitive to opportunities to exploit volumes in specific areas. In some instances, such as, for example, in warehousing, this exploitation may entail hiring a third-party provider under contract because the external firm has the volume (from other customers) to be far more efficient in the warehousing function. In other cases, such as, for example, material acquisition, volume leverage may exist within the VA and should be exploited in the development of distribution alternatives.

Appendix B discusses these design tenets in greater detail and provides additional perspective on current private-sector distribution trends both in the health care industry and in general.

DISTRIBUTION NETWORK ALTERNATIVES

In structuring distribution system alternatives, we characterize possible alternatives in four major dimensions:

- *Facility intensity* – the number and cost of distribution facilities, the type of distribution facilities employed in terms of role or mission, and the size and related processing workload of the distribution facilities in the network
- *Inventory intensity* – the number of inventory echelons used in the distribution system and the range and depth of material stocked for a particular commodity group at a given echelon measured by the dollar value of the inventory investment
- *Transportation intensity* – the extent to which transportation resources (both inbound to the network from external vendors and within the network between processing nodes or facilities) are employed in the network measured by the proportion of total distribution costs related to material movement between facilities
- *Contracting intensity* – the extent to which direct support arrangements (via local purchasing, FSS, Prime Vendor contracting or central contracts) are used to provide material support to the VAMC customer with no intervening stockage in the VA distribution system and the related workload imposed on the contracting function.

The current VA distribution system can be described as both facility-intense and inventory-intense. Almost 200 individual storage locations (VAMC warehouses and VA supply depots) are used to hold 3.5 to 6 months of inventory. At the same time, the current VA system also relies heavily on contracting – both at the local

level and at the NAC – to support the VAMC customer. Transportation intensity is minimal in the current VA distribution system.

Most successful private-sector firms are moving to distribution networks that are less facility-intense and inventory-intense but more transportation-intense and contracting-intense. In the framework of the VA customer support environment, this characterization would imply the following four different general approaches to material distribution that may meet the VAMC customer requirements for responsive and reliable delivery of quality material at reasonable costs:

- National support networks
  - National support to VAMC customers through a consolidated "super depot" that serves as the resupply source for regional stockage points positioned to serve predefined VAMCs. This distribution alternative is highly inventory-intense and facility-intense.
  - National support to VAMC customers through a consolidated super depot tied to regional distribution centers that provide break bulk, area delivery to VAMC services and stockage of a limited range and depth of selected material. This alternative is less inventory-intense than the current network.
- Regional support networks
  - Regional support to VAMC customers through a network of full-service regional depots stocking a wide range of drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items. The range and depth of material in these regional depots would be increased to meet ASRT standards, and direct vendor support arrangements (i.e., Prime Vendor contracting) would not be expanded beyond those now in place. Such a regional depot system is highly inventory-intense.
- Local support networks
  - Local support to VAMC customers through the existing VAMC warehouses. Warehouse inventory range and depth would be revised to reflect the absence of any VA depot system; material would be delivered to VAMC warehouses directly from vendors under a mix of local, FSS, and centralized contractual vehicles. Such a decentralized distribution network is highly inventory-intense and transportation-intense.
- Direct vendor support networks
  - Direct support arrangements (including Prime Vendor contracting, FSS, and centralized contracts with provisions for direct ordering by the

VAMC) and no intervening inventory/material handling in the VA distribution network. Such distribution alternatives are typically called "just-in-time" (JIT) systems in the private-sector health care industry. Such a distribution network is extremely transportation-intense and contracting-intense but essentially has no facility intensity nor inventory intensity.

- Direct support arrangements with limited intervening inventory and material handling in the VA distribution network. The network would have processing facilities that essentially provide break bulk, area delivery to VAMC services and stockage of a limited range and depth of selected material. Such processing facilities are referred to as "distribution centers" in this analysis to distinguish them from depots: facilities that have a traditional receipt, storage, issue, and shipment mission. Such a distribution network is relatively transportation-intense and contracting-intense.

In our June 1992 report, we presented the VA with six alternative material distribution strategies corresponding to the discussion above. Those strategies are presented and discussed in detail in Appendix C. We recommended four of the strategies for further analysis. Chapter 3 presents our analysis.

CHAPTER 3

ANALYSIS OF ALTERNATIVES

In our interim report[1] we identified six alternative distribution systems for VA that meet proposed ASRT standards. In that report we recommended that four of those alternatives be modeled in greater detail to identify costs and to determine the best location for any warehousing facilities that would be required. We used a combination of commercially available software and custom programming to mathematically model the alternatives, and we compared their costs with those of the current system to identify potential savings. The current system is not a viable alternative because it cannot meet the proposed ASRT standards; its costs are described for comparison purposes only.

ALTERNATIVES MODELED

We analyzed four alternatives using our mathematical model. They are sequentially labeled Alternatives 2, 3, 5, and 6. Alternatives 1 and 4 from the interim report were dropped from consideration prior to our detailed analysis. Each alternative is summarized below and is described in detail in Appendix C.

Alternative 2: Super Depot with Regional Distribution Centers

Alternative 2 consists of a single, large "super depot" stocking 3,500 to 5,000 pharmaceutical, medical supply, and nonperishable subsistence items. This consolidated depot would serve the entire population of VAMC customers directly. Alternative 2 also calls for a network of 10 to 12 regional distribution centers (RDCs) that would provide "break-bulk" and "cross-dock" delivery services to a predefined group of VAMCs in cases where transportation and handling economics make direct deliveries to the VAMCs cost prohibitive.[2] They would also stock a limited range of

[1]Appendix C contains material from our interim report that describes all alternatives considered.

[2]A break-bulk operation receives and distributes large containers of material whose contents include many smaller containers that are prepackaged for individual customers. A cross-dock operation receives large quantities of a single item from a vendor, repackages those items, and then distributes them to customers.

nonperishable subsistence items and medical supplies in cases in which local deliveries are uneconomical or sufficient storage space for minimum quantities is not available at the VAMCs. Under this alternative, all medical centers in the contiguous 48 states would be located within 2,000 miles of the super depot and within 500 miles of the closest RDC.

Alternative 3: Regional Depots

Alternative 3 decentralizes the current three-site VA depot network and establishes a decentralized network of six to eight regional depots servicing a predefined set of VAMCs. These regional depots would stock 3,500 to 5,000 pharmaceutical, medical supply, and nonperishable subsistence items. Under this alternative, all medical centers in the contiguous 48 states would be located within 1,000 miles of a regional depot.

Alternative 5: Direct Support with RDCs

Alternative 5 combines direct support with RDCs. Most items would be obtained through either the Prime Vendor system, local distributors, or direct vendor channels. The RDCs would stock small amounts of material when the economics of doing so are attractive to the VAMCs and would occasionally serve as break-bulk facilities for deliveries to the VAMCs. The purpose of the RDCs is to retain the flexibility of in-house processing capabilities for selected items and to minimize the risks associated with a heavy reliance on direct support. As in Alternative 2, all medical centers in the contiguous 48 states would be located within 500 miles of the closest RDC.

Alternative 6: Direct Support

Alternative 6 relies on 100 percent support through either Prime Vendor, local distributor, or direct vendor channels.

VERSIONS OF ALTERNATIVES

Based on discussions with the OA&MM and VHA staffs, we modeled different versions of each alternative, varying the amounts of product obtained through different distribution channels. We considered the following channels:

- *Depot direct* – includes items obtained by the VAMC directly from a current depot, a super depot, or a regional depot
- *RDC direct* – includes items obtained by the VAMC directly from an RDC
- *Local direct* – includes items obtained by the VAMC directly from a local distributor
- *Prime Vendor* – includes items obtained by the VAMC from a local Prime Vendor
- *Vendor direct* – includes items obtained by the VAMC directly from a manufacturer
- *Depot VAMC warehouse* – includes items obtained by the VAMC from its own warehouse and sourced from one of the current depots
- *Local VAMC warehouse* – includes items obtained by the VAMC from its own warehouse and sourced from either a nondepot distributor or from a manufacturer.

Each case we modeled is labeled with the alternative number followed by a version number for that alternative. For example, Case 2-1 refers to Alternative 2, Version 1. Alternatives 2, 3, and 5 each have three versions; the higher the version number, the greater the reliance that is placed on direct support alternatives. We also modeled two versions of the baseline, one representing the current structure and one representing the current structure but using weekly shipments instead of 30-day shipments since that represents a likely future scenario for VA. Those cases are labeled "B-1" and "B-2," respectively. Table 3-1 shows the percentage of dollar volume flowing through each distribution channel for each case. The percentages are shown separately for drugs and pharmaceutical items, medical supplies, and nonperishable subsistence items. We modeled 12 cases including the baseline and modified baseline.

TABLE 3-1

PERCENT VOLUME BY COMMODITY GROUP AND CHANNEL FOR EACH CASE

Commodity and channel	Case											
	B-1	B-2	2-1	2-2	2-3	3-1	3-2	3-3	5-1	5-2	5-3	6-1
Drugs and pharmaceuticals												
Depot direct	15.3	15.3	94.0	75.0	50.0	90.0	72.0	50.0	0.0	0.0	0.0	0.0
RDC direct	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	16.0	10.0	0.0
Local direct	30.3	30.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Prime Vendor	15.0	15.0	0.0	20.0	45.0	0.0	20.0	45.0	50.0	75.0	85.0	90.0
Vendor direct	5.0	5.0	5.0	4.0	4.0	9.0	7.0	4.0	9.0	8.0	4.0	9.0
Depot VAMC warehouse	13.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local VAMC warehouse	21.4	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Medical supplies												
Depot direct	2.9	2.9	87.0	75.0	60.0	88.0	80.0	68.0	0.0	0.0	0.0	0.0
RDC direct	0.0	0.0	0.0	3.0	8.0	0.0	0.0	0.0	60.0	38.0	13.0	0.0
Local direct	60.1	60.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Prime Vendor	0.0	0.0	0.0	10.0	20.0	0.0	10.0	20.0	28.0	50.0	75.0	90.0
Vendor direct	7.0	7.0	10.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0
Depot VAMC warehouse	7.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local VAMC warehouse	22.8	22.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nonperishable subsistence items												
Depot direct	24.9	24.9	85.0	80.0	55.0	93.0	93.0	78.0	0.0	0.0	0.0	0.0
RDC direct	0.0	0.0	10.0	14.0	24.0	0.0	0.0	0.0	91.0	71.0	52.0	0.0
Local direct	30.1	30.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Prime Vendor	0.0	0.0	0.0	0.0	15.0	0.0	0.0	15.0	0.0	20.0	40.0	93.0
Vendor direct	12.0	12.0	4.0	5.0	5.0	6.0	6.0	6.0	8.0	8.0	7.0	6.0
Depot VAMC warehouse	14.6	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Local VAMC warehouse	18.4	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

MODELING DATA

The data used in our modeling efforts came from several sources. The origin of each type of data is described below. The actual data used are shown in Appendix D.

Fixed Facility Costs

Fixed facility costs were used in the baseline cases (B-1 and B-2) only. They included the equivalent rental cost (using GSA-provided regional rates) of each of the three depots. These costs were divided among drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items in proportion to the space taken up by each of those commodities.

Storage Costs

Storage costs include the costs of utilities and maintenance in all of the cases. In the nonbaseline cases, they also include the equivalent lease costs using GSA-provided regional rates. These costs were also divided among drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items in proportion to the space taken up by each commodity.

Handling Costs

Handling costs include labor costs and depreciation of material handling equipment. These costs are divided among drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items in proportion to the line-item activity of each commodity.

Transportation Costs

Transportation rates used were Class 50 rates with a 57 percent discount, equivalent to what the VA is currently experiencing. In each case, different amounts of material are shipped at a time; hence, we use different average freight costs per hundredweight. We use transportation costs for inland freight only and do not include the cost of transporting over the water to Hawaii and Puerto Rico.

Inventory Data

Our models use an average of 2.5 months of supply for the baseline, 3.5 months of supply for regional depots, 1.5 months of supply for a centrally managed super

depot, and 1.5 months of supply for small amounts of centrally managed material located at RDCs. Those numbers are consistent with current VA order sizing criteria. These rules reflect the fact that inventory increases as the number of independently managed sites increase.

Demand Locations

We used as demand locations the locations of the 172 VA medical centers. Each location was modeled with its longitude and latitude coordinate.

Aggregate Baseline Demand Data

Aggregate baseline data for depot items were provided by commodity group by VA Central Office. Nondepot data were obtained through surveying each VAMC.

Percent Volume by Channel and Commodity

The baseline volume percentages we used are consistent with the baseline data described above. The nonbaseline volume percentages we used are part of each original case definition agreed to by OA&MM and VHA.

Specific Demand Data for Each Demand Center

Demand centers were assigned one of four complexity levels and within a given complexity level, each demand center was modeled with the same demand data for a given commodity group. The complexity level groupings and their corresponding weights were based on VAMC survey data. The total demand for a given channel across all demand centers is consistent with the volume percentages described above.

Inventory Holding Costs

We used a 10 percent factor to determine the cost of holding inventory. Inventory holding costs include cost of capital and inventory risk costs (obsolescence, damage, shrinkage, and relocation). The Office of Management and Budget (OMB) recommends using a 10 percent cost of capital for economic analyses of this type.

VAMC Warehouse Storage and Handling Costs

We used actual storage and handling costs obtained from VAMC surveys. Where data were not available for a facility, we estimated them storage-and-handling costs on the basis of their complexity levels. In the model, these costs are

divided by commodity group on the basis of space requirements for storage costs and line-item activity for handling costs.

VAMC Warehouse Inventory

We used actual inventory levels tracked by the supply fund activity. We divided inventory by commodity group on the basis of throughput within each commodity group.

National Acquisition Center Staffing

The NAC staffing levels are part of each original case definition. These levels are based on the expected additional workload that each case would require for increased contracting support.

Price Premium by Channel and Commodity

The price represents the difference in VA purchase price, including any value-added distribution charges, between depot price and the price for the channel being analyzed. We used a 2 percent price premium for all drugs and pharmaceuticals obtained through any channel other than depot direct, a 3 percent premium for non-depot medical supplies, and a 5 percent premium for nondepot subsistence items.

Labor Information

The cost of labor is included in handling costs. Our model prints out the approximate number of direct labor employees needed for each recommended facility in each case. The conversion factors we used to compute the number of employees are consistent with the costs described above. They are different for each of the three commodity groups modeled.

Square Footage Information

The cost of facilities is included in the fixed facility costs and the storage costs described. Our model prints an estimated size for each facility recommended in each case. The conversion factors used to compute that size are consistent with the cost data described. The conversion factors are different for each of the three commodity groups modeled.

Miscellaneous

Miscellaneous data used in the modeling efforts include the average cost of NAC personnel (based on actual payroll data) and the minimum number of employees needed at an RDC (set to three).

RESULTS

We used a three-step process to compute our results. First, we determined the cost of the baseline cases (B-1 and B-2) using our model. Second, we determined the exact location of the super depot and the number and locations of the regional depots and the RDCs to be used in the alternatives. Third, we used our mathematical model to determine the various cost components for each case. The cost components include warehousing, transporting, inventory holding, price premiums for nondepot procurements, and the cost of NAC staffing. These costs are reflected as a percentage of total throughput for each case. Appendix E contains a detailed listing of our results.

Baseline Cost

Based on data collected from VA sources, the model calculated the annual cost of the baseline to be $138 million. Figure 3-1 illustrates the relationship of the various components of this cost. The largest cost component is for warehousing activity, 67 percent, including facility costs, storage costs, and handling costs at the depots and the VAMC warehouses. That cost is driven to a large extent by the VAMC warehouses. Transportation costs account for only about 2 percent of the total baseline distribution system costs.

Facility Locations

We used our mathematical model to compare the tradeoffs between transportation costs, facility costs, and service levels. Specifically, we minimized both transportation costs and the number of facilities subject to the service constraints described above for each alternative. Table 3-2 shows our recommended facility locations for the super depot, the regional depots, and the RDCs. In all cases, we attempted to use the existing depots and locations with VAMCs nearby.

The super depot is located in Kansas City, Mo. We found that the geographic center of demand is actually in Columbus, Ohio, and in fact, solutions with the super

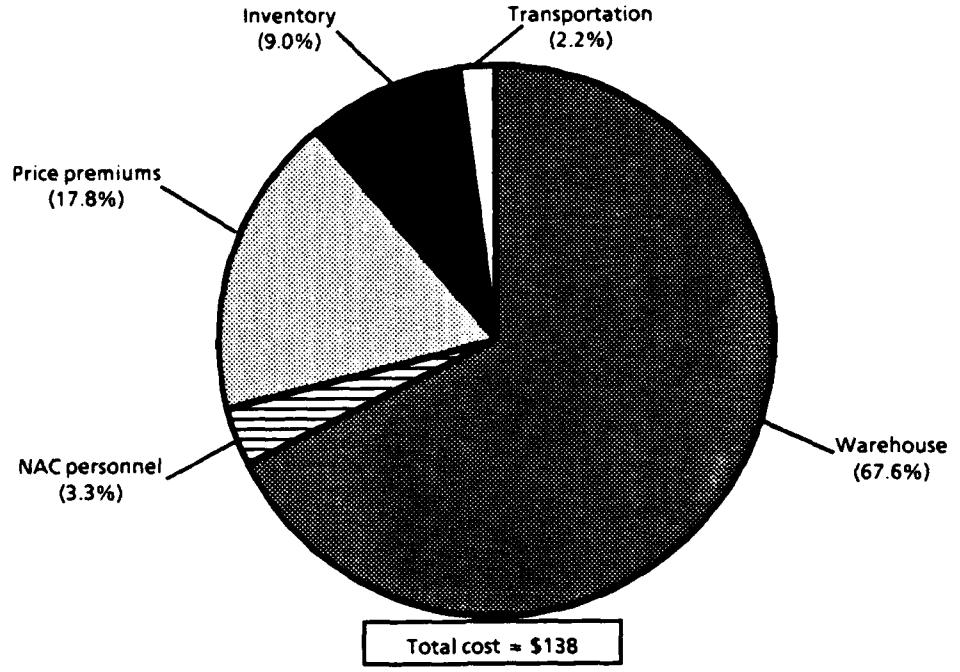


FIG. 3-1. VA DISTRIBUTION SYSTEM
(Baseline costs)

depot either there or in Chicago, Ill., produced lower cost results (by a small amount) but did not meet the service requirement of being within 2,000 miles of all VAMCs.

The regional depot alternative required six to eight depots located so each VAMC would be within 1,000 miles of a depot. We were easily able to find a solution with six depots. The low-cost solution was to locate these six depots in Atlanta, Chicago, Dallas, Los Angeles, Seattle, and Somerville.

Alternatives utilizing RDCs call for 10 to 12 facilities located so each VAMC would be within 500 miles of an RDC. Our best solution calls for 12 RDCs located in Albuquerque, Chicago, Cleveland, Dallas, Denver, Jacksonville, Kansas City, Los Angeles, Memphis, Seattle, Somerville, and Ogden.[3] Appendix F contains a list of each VAMC, its assigned super depot, regional depot, and RDC location and the distances to those locations.

[3]All VAMCs are within 500 miles of an RDC except for Fargo, N.D., which is 643 miles from the Kansas City RDC. Special transportation arrangements may need to be made to ensure that material is delivered within 24 hours to the Fargo VAMC.

TABLE 3-2

RECOMMENDED FACILITY LOCATIONS

Super depot	Regional depots	RDCs
Kansas City, Mo.	Atlanta, Ga. Chicago, Ill. Dallas, Tex. Los Angeles, Cal. Seattle, Wash. Somerville, N.J.	Albuquerque, N. Mex. Chicago, Ill. Cleveland, Ohio Dallas, Tex. Denver, Col. Jacksonville, Fla. Kansas City, Mo. Los Angeles, Cal. Memphis, Tenn. Seattle, Wash. Somerville, N.J. Ogden, Utah

Costs of Alternatives

Table 3-3 shows the costs of the baseline cases and the costs of each of the proposed alternative distribution systems. The costs are stated as a percentage of total dollar throughput. They range from 3 percent of throughput for Case 6-1 (direct support) to 10.8 percent of throughput for Case B-1. In general, the alternatives with greater direct support cost less than alternatives with in-house warehousing. Also, the greater the direct support within a given alternative, the lower the cost of that alternative.

Table 3-4 shows how the total costs for each of the alternatives are split between commodity groups. In all cases, drugs are the least costly followed by medical supplies and then nonperishable subsistence items. The ranges are very different for the three commodity groups. Appendix E shows more results in depth including a breakdown of each of the cost components (warehousing, transportation, inventory holding, price premium, and NAC staffing) broken down by distribution channel and commodity group for each case.

TABLE 3-3

MODELING RESULTS

(Percent of throughput dollars)

Case	Description	Total cost (percent of throughput)
B-1	Baseline	10.8
B-2	Baseline with 100 percent USXPRESS	10.7
2-1	Super depot and RDCs – pure	7.3
2-2	Super depot and RDCs – limited Prime Vendor	7.0
2-3	Super depot and RDCs – full Prime Vendor	6.5
3-1	Regional depots – pure	10.1
3-2	Regional depots – limited Prime Vendor	9.4
3-3	Regional depots – full Prime Vendor	8.3
5-1	Direct support and RDCs – limited Prime Vendor	6.7
5-2	Direct support and RDCs – medium Prime Vendor	5.3
5-3	Direct support and RDCs – full Prime Vendor	4.1
6-1	Direct support	3.0

SENSITIVITY

We conducted a sensitivity analysis on the price premiums used for nondepot delivery channels. Our results were based on the assumption that products not delivered to depots will cost the VA an additional 2 percent for drugs and pharmaceuticals, 3 percent for medical supplies, and 5 percent for nonperishable subsistence items (this includes Prime Vendor delivery, local delivery, and direct vendor delivery channels). Because the marketplace for hospital supplies is changing very rapidly, we explored the effects of changing this assumption on the results of our analysis indicating that direct support is less costly than depot support. We wanted to know how our assumption on price premiums affects that result. Specifically, we asked the question, "At what price premium for nondepot channels do depots become cost effective?"

TABLE 3-4

MODELING RESULTS BY COMMODITY GROUP

(Costs as a percent of throughput dollars)

Case	Drugs and pharmaceuticals	Medical supplies	Nonperishable subsistence items
B-1	4.9	18.4	42.7
B-2	4.7	18.3	44.2
2-1	2.8	13.0	32.8
2-2	2.7	12.1	33.2
2-3	2.6	11.2	30.1
3-1	4.3	17.7	38.1
3-2	3.9	16.5	38.5
3-3	3.4	14.7	34.5
5-1	3.2	10.5	31.4
5-2	2.6	8.0	27.6
5-3	2.5	5.1	23.9
6-1	2.3	3.6	10.6

Table 3-5 shows the break-even points for each commodity group determined from our sensitivity analysis. We show those points only for Alternatives 2 and 3 since Alternatives 5 and 6 do not contain depots. The break-even points did not change significantly between versions of each alternative. In the case of the super depot (Alternative 2), the break-even price premiums are 2.6 percent, 14.2 percent, and 29.9 percent for drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items, respectively. Those numbers change to 4.3 percent, 19.3 percent and 35.7 percent, respectively, for the six regional depots in Alternative 3. We also computed break-even points for the current three-depot system without the VAMC warehouses and their associated costs for comparison purposes only. That computation resulted in break-even price premiums of 3.2 percent for drugs and pharmaceuticals, 13.0 percent for medical supplies, and 25.7 percent for nonperishable subsistence items. Those percentages would be considerably higher had we included the VAMC warehouses and their associated costs in the analysis.

TABLE 3-5

BREAK-EVEN PRICE PREMIUMS

(Percent of throughput dollars)

Case	Pharmaceuticals	Medical supplies	Nonperishable subsistence items
2-1	2.57	13.84	28.39
2-2	2.58	13.95	29.13
2-3	2.60	14.20	29.91
3-1	4.26	19.07	34.56
3-2	4.26	19.14	35.07
3-3	4.25	19.33	35.69

The break-even analysis shows that the modeling results, which indicate that direct support is more economical than depot support, would not change even if price premiums were to change. As long as price premiums stay within the limits shown in Table 3-5, the depot alternatives are not preferable to direct support.

ADDITIONAL SCENARIOS

At the request of OA&MM, we modeled two additional scenarios: the baseline without VAMC warehouse support and the current depot structure without VAMC warehouse support and a much higher level of Prime Vendor support.

Additional Scenario 1: Baseline Without VAMC Warehouse Support

This scenario consists of using the three existing depots with their throughput levels, to serve the VAMCs directly with a USXPRESS delivery strategy for all three commodity groups. The cost of this scenario is 4 percent of throughput, substantially less than the cost of the same system with the VAMC warehouses. However, this scenario does not meet the proposed ASRT standards for any commodity. (Remember, the proposed standards are 5 days, 10 days, and 7 days for drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items, respectively.) The ASRTs resulting from this scenario are 16 days, 25 days, and 21 days, respectively. Although it is cost-efficient, this scenario cannot meet the needs of the VAMCs.

Additional Scenario 2: Baseline with High Prime Vendor Support

This scenario consists of high throughput using the existing depot system and extensive Prime Vendor support. It does not include any VAMC warehouses. Table 3-6 shows the exact source mix used for each commodity group in this scenario. The cost of this scenario is 7.3 percent of throughput, which is high in comparison to some of the direct support cases that we modeled. In addition, this alternative does not satisfy the proposed subsistence ASRT for 18 percent of the VAMCs and 15 percent of the total VAMC subsistence demand. In order to meet ASRT for subsistence, inventory would have to be added at selected VAMCs. That addition would make this scenario even more expensive.

TABLE 3-6

SOURCE MIX FOR ADDITIONAL SCENARIO 2

(Percent of throughput dollars)

Case description	Drugs and pharmaceuticals	Medical supplies	Non-perishable subsistence items
Depot direct	47.0	54.0	93.0
Prime Vendor	47.0	36.0	0.0
Local purchase	1.0	3.0	1.0
Vendor direct	5.0	7.0	6.0

MODELING EFFORT CONCLUSIONS

Our analysis helped us understand the interrelated effects of inventory, transportation, warehousing, and price premiums among each of the available distribution channels for the three commodity groups. We have drawn five key conclusions from our modeling efforts. First, the current system is expensive. All versions of the four proposed alternative distribution strategies are cheaper than the current annual costs of $138 million. The current system does not meet our proposed ASRT requirements, and all of the alternatives we modeled do. The VAMC warehouses contribute a large amount to the total current system costs, but without them ASRT becomes longer.

Second, the costs of distributing drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items through both the current system and the proposed alternatives are driven more by inventory and warehousing than by transportation. We found it more cost effective to decrease inventories and facility costs at the expense of added transportation cost.

Third, we found that although some cost advantage is available by combining the three commodity groups into single shipments for transportation purposes, that advantage is relatively small. Because transportation is the only direct cost that can be reduced by combining distribution of the three commodities together and because this combinatorial effect is small, distribution costs may be split by commodity group for decision-making purposes. We found that the total cost for all channels in the current system is actually 4.9 percent for drugs and pharmaceuticals, 18.4 percent for medical supplies, and 42.7 percent for nonperishable subsistence items. These numbers change with each alternative, but their relationship to one another remains the same.

Fourth, we found that within any of the alternatives, higher levels of direct support result in lower cost. We also found that between alternatives, more direct support results in lower cost. Both of these findings are driven by the result that the marginal cost of distributing an item through a depot is higher than the marginal cost of distributing that same item through a direct support arrangement for all three commodity groups. The more items that VA can distribute through a direct support arrangement, the lower the overall total cost.

Finally, we found that our results are relatively insensitive to price premiums for medical supplies and nonperishable subsistence items. They are more sensitive to price premiums for drugs and pharmaceuticals but only with the super depot alternative. In accordance with industry experience, our analysis assumed a price premium of 3 percent for nondepot-procured medical supplies. We found that the price of medical supplies through direct support channels must be between 14 and 19 percent higher than the price of those same items delivered to a depot before the depot alternatives begin to make economic sense. For nonperishable subsistence items, we used a price premium of 5 percent for nondepot-procured items and found that the break-even point is between 28 and 36 percent, depending on the depot alternative being considered. For pharmaceuticals, we assumed a price premium of 2 percent and found the break-even point to be 2.6 percent for the super depot alternative and

4.3 percent for the regional depot alternative. Only in the case of pharmaceuticals being supplied from a super depot did we find that our results may be sensitive to our assumption about the additional amount paid for nondepot deliveries. We believe that the risks associated with the super depot alternative, as well as the high costs of a transition to that alternative, would preclude its selection unless savings are far greater than the break-even percentage shown.

CHAPTER 4

CONCLUSIONS AND RECOMMENDATIONS

Our analysis of material distribution alternatives for the VA leads to the conclusion that the VA can improve the responsiveness and at the same time reduce the cost of VA's material distribution system. Although the improvements now being made to the system (Prime Vendor contracting and USXPRESS initiatives) will enhance current system capabilities, much more is possible.

Before anything else, we believe that supply network customers and providers must agree on the level of service needed and how network performance will be measured. In our visits to private-sector hospitals with successful "stockless" systems, we were repeatedly told that successful changes in material support systems depends on a clear understanding of customer expectations and system objectives by all parties concerned. We do not believe that such an understanding exists now in the VA.

We identified responsiveness standards for VA customers based on our field visits, and we believe that the VA can best satisfy them with a distribution strategy that relies heavily on direct support by vendors, particularly for pharmaceutical products, with regional distribution centers to handle only a small number of items for which direct distribution is uneconomical. Such a strategy would use responsive commercial distribution capabilities to the VA's advantage while retaining an in-house capability to distribute specific items when it makes sense to do so. It would eliminate the need for expensive medical center warehouse inventories and would accommodate the trend among manufacturers to eliminate or reduce substantial price discounts for depot orders. The transition to the new strategy can be made quickly and without significant disruption of service.

SHARED PERFORMANCE STANDARDS

During our visits to the medical centers and in meetings with the VHA staff, VA personnel – particularly pharmacy representatives – expressed a considerable amount of frustration about the slowness of the VA supply system and its lack of reliability. Customer expectations, especially on the VHA staff, are extremely high,

with the conviction that it should be possible to design a system to satisfy all demand within 24 hours. The OA&MM staff is devoting considerable effort to improving the service level, but its efforts will still fall short of VHA's desires and, from our experience, the desires of the medical center customers. Those customers believe that improvement is being made but at far too slow a pace.

We could find nobody in VA who knew what customers were actually experiencing in terms of supply system responsiveness. The OA&MM staff had some performance statistics for depot-supplied items, but from the customers' perspectives, direct depot orders account for only 11 percent of total consumption. Medical center warehouse responsiveness was the topic of many animated discussions during our visits to the field, but we found no customers who could discuss actual performance statistics. Similarly, local purchases, which account for nearly one-third of medical center consumption, are considered very slow, but corroborating data are not readily available.

We believe the VA must know how responsive its entire material support system is not merely how responsive the depots are. Customers should know how responsive the supply system is to their needs. If they are to effectively argue for improved support, they must know what level of support they are getting and should be able to specify the exact level of support they want. The OA&MM staff also needs to know how well the system performs as a whole so it can determine how to modify each channel to satisfy the customers' objectives.

We recommend that the Assistant Secretary for Acquisition begin a dialog with VHA to define specific material support responsiveness standards for medical center customers for each of the three main commodity groups: drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items. The ASRT standards that we defined and used in this study (Table 2-5) can serve as a logical point of departure. We strongly believe that the standards should not vary from one medical center to another if the VA is to prevent the unnecessary and costly retention of local inventories.

We also recommend that OA&MM build a capability to measure performance relative to the responsiveness standards. OA&MM must be able to measure the performance of all supply channels from a customer perspective. The measurement

"clock" must be started and stopped by the same activities for each supply channel so that performance of each channel may be directly compared to others.

Despite the fact that not all supply channels are managed and regulated by OA&MM, OA&MM must have the ability to measure the performance of *all* supply channels. Customers must be routinely made aware of total supply system performance, and responsiveness standards should be adjusted over time as new or improved distribution alternatives are identified. Responsiveness standards and measures will allow VHA, OA&MM, and the medical centers to agree on supply system objectives – and determine whether the system is satisfying those objectives – with significantly less frustration than they experience now.

RECOMMENDED DISTRIBUTION STRATEGY

As we discussed in Chapter 3, the current VA distribution system is not only more expensive than the alternatives we modeled, it is also less responsive. Even with full implementation of the USXPRESS initiative, the system will still be unable to satisfy the ASRT levels we used to develop all of our alternatives. Any alternative we modeled will provide better service than the current system – and at an equal or lower cost. Our analysis shows that networks that rely more heavily on direct support are less costly than are those that do not.

The quickest way to reduce supply system costs would be to eliminate the system's most costly feature, the medical center inventories (and the personnel and facilities used to maintain them). Simply phasing out those inventories, however, will not be enough because the resulting system will not be responsive enough to meet the ASRT standards we recommend.

We believe that the alternative that will best satisfy the VA's needs is direct support with regional distribution centers. That alternative offers the most flexibility of those that we modeled plus considerably lower investment costs than a super depot or regional depots. In the current dynamic pricing environment, it provides some assurance of an alternative distribution channel for a few specific items for which economies cannot be achieved using direct support.

We recommend that the VA change its material support strategy to one that provides material to its medical centers through direct support channels augmented with RDCs. This is the most attractive alternative available to the VA for three

reasons: its costs are quite low; it provides the Department some flexibility and insurance in determining distribution channels for specific items; and transition to such a strategy should be relatively easy, requiring less capital investment than the other alternatives we modeled.

This alternative requires that VAMC "posted" stocks be phased out along with the personnel and facilities needed to maintain them. In the short term, it also means that the depots need to be more responsive to customers' needs. In the long term, the need for the depots as significant material stocking points will be eliminated.

Regional distribution centers would be unlike any current facilities in the VA supply system, and they will differ from each other. In the system we visualize, the RDCs will vary in size and in the number of demand points they will serve. They substitute for neither the depots nor the VAMC warehouses; their mission differs from both.

The RDCs will have three functions. First, they will serve as single regional delivery points for vendors to use in cases when the transportation and handling economics make direct delivery cost prohibitive. The RDCs will provide either cross-docking or break-bulk services under this scenario. Second, some direct support contracts, such as those written for distribution of dietary supplements, require that VA customers order material in minimum quantities. The space needed to stock those quantities of items may exceed that available in the medical center to store them. Therefore, the RDC will serve as an alternative delivery point capable of storing and distributing such items. Third, the RDCs will provide limited flexibility to stock items for which the VA cannot contract under direct support arrangements at a reasonable cost. Our discussions with VA staff indicate that some items, mainly in the medical supply and subsistence commodities, fall into this category. In such cases, both the local purchase and RDC options should be considered as delivery channels.

We recommend that the VA establish 12 RDCs and that they be located in or near Chicago, Ill.; Cleveland, Ohio; Dallas, Tex.; Denver, Col.; Jacksonville, Fla.; Kansas City, Mo.; Los Angeles, Cal.; Memphis, Tenn.; Seattle, Wash.; Somerville, N.J.; Ogden, Utah; and Albuquerque, N. Mex. As discussed in Chapter 3, those locations will enable the VA to minimize total distribution system costs while meeting cus-

tomer service objectives. Furthermore, the VA currently has medical centers and warehouses in or near each of those locations, easing the transition.

The size and total workload of the RDCs will be dictated by the product prices the VA can obtain from its vendors. The decision to use the RDCs as stock points must be based on the "delivered" cost to the VA customer. That is, the price of an item stocked in the RDC plus the total cost of storing, handling, and transporting the item must be lower than the best possible delivered cost for the same item from the vendor. We provide some estimates of RDC size and workload in Chapter 3 and in Appendix E. Those estimates should serve primarily as guidelines for the transition staff.

Table 4-1, taken from our modeling results, shows the throughput volumes, operating costs, and staffing requirements for each RDC under the highest level of direct support. Throughput volumes, facility size, operating costs, and staffing will vary among RDCs because each distribution point will serve a unique customer set both in number of demand points and in demand volume (as shown in Appendices E and F). For each RDC, the customer base remains constant under different levels of direct support, but the volume of material flowing through the facility differs proportionately to the volume of direct support. Some uncertainties, such as specific throughput volumes and RDC facility sizes, must be addressed during transition.

TRANSITION STRATEGY

To make the transition from its current material support strategy to the strategy we recommend, the VA will need to take the following actions:

- Draw down depot-sourced inventories and warehouse personnel from the medical centers.
- Improve depot responsiveness by using USXPRESS for all depot requisitions.
- As quickly as possible, establish Prime Vendor contracts for the medical supply and subsistence commodities and expand Prime Vendor coverage to all VAMCs.
- Establish RDC locations early and push to close warehouses in other medical centers as quickly as possible. If necessary, consolidate remaining medical center stocks into the RDCs to accelerate the closure of the warehouses.

TABLE 4-1

REGIONAL DISTRIBUTION CENTER PROFILES

RDC location	Throughput ($000)	Facility size (sq ft)	Operating costs ($000)	Staffing (FTE)[a]
Albuquerque, N. Mex.	5,804	29,000	287	4
Chicago, Ill.	21,669	110,367	1,248	14
Cleveland, Ohio	26,056	136,985	1,546	17
Dallas, Tex.	14,488	70,678	703	9
Denver, Col.	2,719	10,111	130	3
Jacksonville, Fla.	13,580	66,471	875	8
Kansas City, Mo.	6,072	27,047	378	3
Los Angeles, Cal.	15,758	77,731	950	10
Memphis, Tenn.	11,103	53,281	704	7
Seattle, Wash.	6,425	32,810	410	4
Somerville, N.J.	32,680	151,939	1,965	19
Ogden, Utah	3,573	17,645	218	3

Note: FTE = full time equivalents.
[a]Direct labor employee.

- Establish direct support contracts for depot-stocked items in every instance when it is economically feasible to do so. When it is not, specify delivery to the 12 RDCs, instead of the current three depots.
- Reduce depot stocks, space, and staffing to the level necessary to perform their new RDC missions.

Two factors are critical to successful accomplishment of the transition. First, the VA must be able to quickly replace medical center inventories with responsive depot support (USXPRESS) and direct support (Prime Vendor) so that customers do not suffer a loss of responsiveness and reliability. Second, the NAC must be able to expand Prime Vendor contracting to all commodities and all areas while also converting depot supply contracts to direct support or RDC contracts concurrent with the VAMCs' transition to RDCs. Both factors will tax VA central office management.

As the VAMC posted stocks are phased out, system savings will accrue quickly. As we showed in Chapter 3, the medical center-posted stock inventories and their related maintenance support structure comprise about 64 percent of current VA

distribution costs. However, the material management and acquisition staffs must remain focused on reaching their ASRT objectives since dissolution of posted stocks will increase the response time for each commodity group. Converting items quickly to direct support will enable the VA to substantially reduce the ASRT for all three commodities.

For that reason, if NAC capabilities become a limiting factor, the emphasis should focus on emplacing Prime Vendor contracts for all three commodity groups and at all VAMCs. Only then should the NAC transform depot supply contracts to direct support contracts or, in cases in which costs are prohibitive under a direct support arrangement, add items to RDC stock or pass them through the RDCs under a cross-docking arrangement.

Manpower planning will be critical to the transition effort. While many full-time equivalent (FTE) positions will be made surplus at the medical centers, new ones will be required at the RDCs, the NAC, and – for a short time – the depots. To keep costs and disruption at a minimum during the transition, the VA must closely monitor the workload at all levels of the distribution network and identify positions needed to meet critical path requirements.

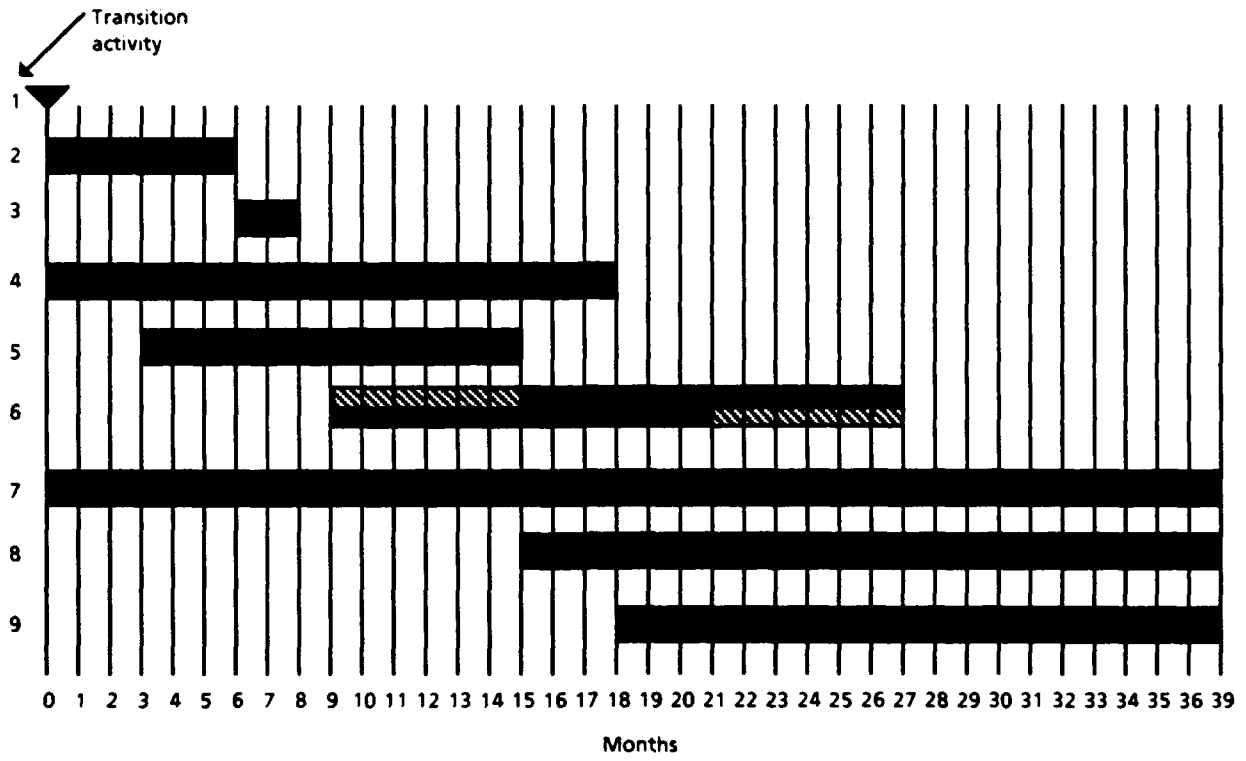
We believe that the transition to the new material support strategy should take about 3 years to complete. A time line of transition activities is shown in Figure 4-1.

TRANSITION COSTS

The transition to VA's new material distribution strategy will have several costs. They will result from

- *Increased workload at the NAC.* Since direct support is more contracting-intense than the current distribution system, the VA will need to increase its contracting staff at the NAC. The current staff includes about 40 contract specialists, but we estimate that it will increase to about 80 specialists during the transition period. That increase would add about $1.7 million annually to the cost of operating NAC (these costs are included in the model output in Appendix E). The additional workload at NAC is a result of increased use of national contracts with a decrease in the use of local contracts.

  The management staffs at NAC and the OA&MM expressed concerns that the NAC contracting staff will need to improve its overall skill level if it is to effectively negotiate large contracts with the VA's suppliers. The cost to do so could range from the cost of one-time training to the cost of increasing



Transition activity

1. Establish transition team.
2. Convert all depot requisitions to USXPRESS.
3. Draw down stocks of depot-sourced items at all VAMC warehouses.
4. Expand Prime Vendor contracts so they supply all commodities to all VAMCs.
5. Establish RDCs. Transition team must locate and obtain facilities and personnel.
6. Close VAMC warehouses – move "must have" stocks to RDCs. Close the VAMC warehouses as soon as the RDCs can support the VAMCs. Start between months 9 and 15 as RDCs become operational.
7. Replace depot supply contracts with direct support contracts where cost effective. Start time depends on NAC's ability to perform activities 4 and 7 simultaneously.
8. Convert remaining depot supply contracts to RDC delivery.
9. Convert depots to RDCs – reduce size of staffs and facilities.

FIG. 4-1. TRANSITION TIME LINE

grades for some or all of the contract specialist positions. We expect that the VA will try the former approach. At a cost of about $2,000 per contract specialist, the one-time cost would be $160,000.

- *Staff reductions at the medical centers* – Although the closure of the medical center warehouses will result in surplus personnel in the medical centers, we expect that many of those positions would be absorbed into other VAMC divisions. Since VAMC local purchase activity will decrease substantially under direct support, each medical center should also experience a reduction in the number of contract specialists it needs. We estimate that some 1,300 medical center FTE positions will be either lost or redesignated by the

time the transition is completed. With severance costs at about 50 percent of annual salary for each position that is lost – and our estimate that about 50 percent of displaced employees would find other Government positions – we estimate a total severance cost of $9.8 million.[1]

- *Staff reductions at the depots* – The depots currently employ about 105 direct labor FTEs. The direct support distribution network with RDCs will require about 94 direct labor FTEs to operate. Although it is likely that many of the RDC positions would in fact be filled from medical center surpluses, we have not computed a cost for depot personnel reductions under the presumption that those reductions would cost the same, on an FTE basis, as those in the medical centers.

- *Conversion of medical center warehouse space* – At some medical centers, warehouse space owned by the VA would be made available for other uses when the medical center warehouses are closed. At others, the space has been leased and the lease would obviously be discontinued. Rather than let unused warehouse space in its facilities go vacant, we would expect the VA to convert the space for other purposes. We have not included the costs of such space conversion as a transition cost.

- *Leasing RDC facilities* – The RDCs will likely be operated out of leased facilities because their throughput dictates that they be larger facilities than the VA currently uses for medical center warehouses. Using GSA data for warehouse lease rates, we estimate that the annual RDC lease costs (including utilities) will be about $5 million (those costs are included in the model output in Appendix E). *We recommend that the VA use leases for its RDC facilities to avoid capital investments for construction and for the flexibility to either expand or contract as throughput dictates.*

- *Managing the transition* – The transition will increase the workload of the central office OA&MM staff, but we do not expect a need to increase the size of that staff. The OA&MM must manage the conversion from medical center warehouses to RDCs, lease new facilities, set up new transportation contracts for regional delivery, determine NAC staffing levels, manage the conversion to direct support contracts, and improve depot responsiveness and then decrease the size of the depots. At the same time, roles in OA&MM will change and the supply fund must be reconfigured to provide necessary funding under the new material support strategy. The OA&MM staff will be heavily tasked, but we believe it is sufficiently large enough to manage the transition without additional staffing.

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[1]We recognize that a small number of warehousemen will still be needed at most medical centers to handle material being delivered from vendors and RDCs. Our reduction figures take that into consideration.

The nonrecurring transition costs described above (contract specialist training and severance pay) would require a one-time outlay of approximately $10 million. Since the direct support with RDC alternative is expected to save at least $53 million per year compared to the current baseline, the payback period for that outlay is considerably less than one year.

HOW THE NEW STRATEGY WILL AFFECT THE VA SUPPLY FUND

The VA supply fund obtains most of its revenues from a surcharge on the sale of depot-stocked material. The fund is used to pay for the inventory in the VA supply depots and medical center warehouses, the operation of the depots, transportation from the depots to the medical centers, and the cost of the NAC and OA&MM staffs.

Under the direct support material distribution strategy, the value of inventory held by the VA would drop by about 80 percent. It is likely that the level of supply fund capitalization would be dramatically reduced. The only costs that would need to be paid for by the supply fund would be the costs of the OA&MM and expanded NAC staffs, costs of the RDCs (facilities, personnel, and limited inventories), local transportation from the RDCs to the medical centers, and Prime Vendor contractor surcharges.

We believe that the supply fund should obtain its revenues from a surcharge on sales for all supply purchases by the medical centers. The surcharge should vary by commodity but not by supply channel. In that way, customers would be able to accurately measure both the cost of the supply system and its responsiveness using two measures: the surcharge and ASRT performance.

SUMMARY

The VA should establish responsiveness standards for its supply systems to specify customer needs. It should measure and report performance in satisfying those standards.

The most cost-effective, long-term material support strategy for the VA is one of direct support with RDCs to handle the small number of items for which direct support is uneconomical. We have recommended that 12 RDCs be established and that medical center warehouses and supply depots be eliminated.

The transition to the new strategy should begin by quickly eliminating expensive medical center warehouses and increasing the number of facilities and commodities with Prime Vendor contracts. The three existing depots will play an interim role: they must be made more responsive in the short run, permitting the medical centers to eliminate posted stocks of depot-supplied items. In the long run, depot supply contracts should be converted to direct support or RDC contracts and the depots should be replaced with much smaller RDCs. We believe that the transition can be completed in 3 years.

CHAPTER 5

MECHANIZATION AND DENVER DISTRIBUTION CENTER

In addition to analyzing distribution alternatives for VA, OA&MM requested that we examine two related topics: mechanization of depots and the location and role of the Denver Distribution Center. We investigated both topics, and in this chapter, we present our conclusions and recommendations for each.

MECHANIZATION

We addressed mechanization both in the current depots and in our recommended strategy for the future. Appendix G contains our report on mechanization opportunities for the current depots that was provided to OA&MM in June 1992. In that report, we concluded that extensive mechanization is not appropriate for the depots because the benefits do not justify the costs. We did make two key recommendations. First, the depots should use an order-batching scheme to pick all USXPRESS orders. The USXPRESS program will continue to create order sizes that are much smaller than those of the current "30-day push" program. If depot personnel continue to pick these orders individually, the VA will need approximately 25 additional FTEs when the program is fully implemented. Order batching will mitigate the effects of this increased workload. Second, we recommended the use of forward pick areas with flow racks and gravity roller conveyors for less-than-case-lot picking of drugs and medical supplies. This type of storage is inexpensive and will support the smaller quantities needed to satisfy USXPRESS orders.

The sizes and throughputs of supplies through the facilities do not support extensive mechanization for the distribution strategy we have recommended in this report. In Chapter 4, we recommended that the VA follow a distribution strategy utilizing direct support with 12 RDCs to store and handle small numbers of items where economics make it attractive to do so. These facilities will be small, ranging in size from 10,000 to 150,000 square feet and employing between 3 and 19 persons depending on throughput.

Extensive mechanization at the RDCs does not make sense for two reasons. First, the potential for labor savings is relatively small. Table 5-1 shows the

estimated handling costs associated with each facility. In order for mechanization to make economic sense, the handling costs for a warehouse facility generally need to be greater than $1 million per year.[1] None of the facilities meets this prerequisite. Second, the RDCs are meant to be flexible in terms of the items they will contain. It does not make sense to invest in automating a facility whose contents and purpose will change over time. For those reasons, we believe that the VA would not benefit from highly mechanized material distribution facilities either in the short or long term.

TABLE 5-1

ESTIMATED ANNUAL HANDLING COSTS FOR DIRECT SUPPORT WITH RDCs

RDC location	Handling cost ($000)
Albuquerque, N. Mex.	153
Chicago, Ill.	586
Cleveland, Ohio	724
Dallas, Tex.	377
Denver, Col.	60
Jacksonville, Fla.	355
Kansas City, Mo.	149
Los Angeles, Cal.	413
Memphis, Tenn.	286
Ogden, Utah	95
Seattle, Wash.	174
Somerville, N.J.	818

DENVER DISTRIBUTION CENTER

The Denver Distribution Center (DDC) is very different from the three VA supply depots. While part of its mission is to receive, store, and issue certain items (hearing aids batteries, and hearing aid accessories; prosthetic hose; items for the blind; flexible orthoses; and elastic hosiery), the majority of its resources are devoted

[1]The $1 million a year figure assumes that the maximum mechanization benefit is equal to 20 percent of handling costs and that a 2-year payback is required for economic justification.

to centralized procurement of prosthetic items and sensory aids, administration of hearing aid repair programs (and testing of hearing aids), and maintaining a comprehensive data base of veterans' prosthetic needs. Only 7 of its 46 FTE positions are devoted to warehousing and distribution.

We visited the DDC and analyzed its placement in the overall VA distribution strategy. We visited the center in February 1992 and have reviewed DDC's *Systematic Review Report* for FY91 and the *Management Review of the VA Prosthetic Distribution Center* dated September 1990.

We conclude that it would be possible to obtain some savings in annual operating costs by combining the DDC with another VA operation. However, those savings would be insignificant in comparison with the savings anticipated from the implementation of our recommended distribution strategy for other commodities. Furthermore, the disruption that would result from moving the DDC would be significant. It has a specialized electronics laboratory of 14 FTEs that would be difficult to quickly recreate in another location, and its procurement activity of 6 FTEs and Veteran Service Division of 6 FTEs, are also specialized and would be difficult to replace. Thus, 26 of the 46 FTEs in the DDC are positions for which a significant learning curve for replacement workers would cause serious disruption if the DDC were moved.

Moving the DDC would also require that the OA&MM staff devote time to planning and overseeing the prosthetics support operation when its time will be needed for the transition to a new supply strategy. We do not consider such a distraction to be in the VA's interest.

Savings from moving the DDC would result from the elimination of overhead positions. We estimate that approximately 6 to 7 of the 46 FTEs could be saved, 2 from the Office of the Director, 1 from the Information Resources Management Division, and 3 to 4 from the Fiscal Division. This assumes that the receiving activities, most probably the NAC and the Hines depot (which we have already recommended be reduced in size), could absorb the additional workload. Annual savings would be from $230,000 to $260,000.

Other opportunities may be available for using the DDC more effectively. It is already established as a mail-out operation for direct support to veterans, and the VHA and OA&MM might jointly identify other items that could be economically

distributed using direct distribution rather than through the medical centers or pharmacies. In other words, the DDC could be expanded to serve other needs where it is economical to do so rather than be relocated and made smaller.

Based on what we have learned about the DDC and our recommendations earlier in this report, we recommend that the OA&MM:

- *Keep the facility in Denver in the near future until the overall supply distribution strategy is implemented.*
- *Jointly with VHA determine how the VA's mail-order or retail item needs should be met. Determine whether the acquisition, technical, automatic data processing (ADP) or direct veterans assistance capabilities at the DDC can economically satisfy those needs.*
- *Organize the DDC around supplying and administering all of those needs.*
- *In the long term, locate the facility where it is most cost-effective in terms of facilities, transportation, and shared overhead costs.*

The DDC is serving a useful purpose and does not appear to be adding significant costs to VA's operations. In light of the proposed changes for distributing other commodities and the disruption those changes will cause, we do not believe that it is appropriate to make any major changes at the DDC in the near term. However, in the long term, the approach we have outlined above should be followed.

APPENDIX A

CUSTOMER-ORIENTED DESIGN CONCEPT

CUSTOMER-ORIENTED DESIGN CONCEPT

INTRODUCTION

In this appendix, we expand on the concepts introduced in Chapter 2, and demonstrate how average system response time (ASRT) can be used in network design. We describe the process by which an alternative network design was selected.

NETWORK DESIGN CONCEPTS

A distribution network is a combination of fixed facilities (warehouses, transportation hubs, etc.), inventories of material, operating equipment, systems, people, and transportation links. Effective network design requires external links (with customers, vendors, and carriers) and internal links (between nodes or facilities) based on some overall support or service objective. The following subsections present the steps in successful network design.

Begin with the Customer

Network design begins with the customer. The notion of "customer-driven" distribution networks is more than a marketing concept; today, it is a reality for many successful firms. Such firms have recognized that the design of a competitive distribution network is a strategic issue, not an analytical exercise. Some specific conditions are generally associated with network design: the number, size, mission, location, and interrelationships of fixed facilities such as warehouses, consolidation centers, and transportation hubs; the sourcing, positioning, and service/cost objectives of material inventories; and the role, modal choice, and sourcing or development of transportation services. Those conditions are increasingly seen as important and relevant only after having established the support objectives or requirements that will be placed on the distribution network.

Thus, it is the market and its related customer service objectives, not the distribution costs, that should drive network design. Distribution costs, which include fixed facility costs, operating costs, inventory acquisition and investment costs, and transportation costs and tradeoffs – often seen as the beginning of

network design – are relevant only in the context of an overall network objective. The organization must first define clearly its customers (or customer groups) and then identify those specific factors that are important to them.

Define Competitive Factors

Companies typically compete in markets on the basis of a number of competitive factors important to their customers. While product/service innovation and technical superiority are often important in the long term, short-run competitive factors typically include cost, quality, dependability, availability, flexibility, and responsiveness.

The relative importance of these separate factors differs by customer and market. However, many current business strategists believe that while the firm must generally rank high in most of the competitive factors, it must be clearly superior in at least one to be successful. Selecting the key competitive factor or factors and defining the capabilities needed to be competitive is the first step in network design.

Most comprehensive studies of private-sector distribution networks (including the annual Council of Logistics Management survey done by the Ohio State University and others) point to a limited number of service factors that appear to be of greatest importance. While costs must be reasonable, in today's environment most surveys indicate that dependability and flexibility are more important to many customers.

In the case of the Department of Veterans Affairs (VA), since material costs are not a major part of operating costs and since the focus of the organization is on capable and responsive medical service, dependable and flexible material support – within reasonable cost bounds – is a viable customer service objective.

Establish Clear Operationally Oriented Network Goals

Linking distribution network design (which is typically couched in "logistics" terms and conducted by logisticians) to the customer compels the materials manager to move outside her or his area of expertise and control. The materials manager must deal with the operator to answer the following questions:

- Who are the major customers to be served by the network?

- Are some of those customers more important than others in terms of the service required from the network?
- What are the specific dimensions of service (by customer category or material category) that the network must provide?
- What level of service is required for those specific service factors considered essential to customer support (by customer category or material category)?

In the case of the VA, the customer of the distribution network is clearly not the patient. However, the customer could be considered the medical center warehouse, the facility storeroom or material manager, or the VA hospital or medical center operator; therefore, we must define the boundaries of the network. For purposes of this study, we assume that the distribution network extends to all levels of material management, including the medical center warehouse and that the customer is the internal organization (pharmacy, dietetics, laboratory services, etc.) that serves medical center providers. Such a customer identification allows us to focus directly on the service dimensions that are important to the customer.

Inventory turn, fill rate, investment levels, order-and-shipping times, procurement lead times, sourcing and acquisition methods, etc., are issues that are of limited interest to the customer. Thus, as reflected in the final two questions above, we must ultimately come to grips with the one or two specific factors that are relevant to the customer. We must define what the customer needs from the distribution network. For most private-sector and public-sector organizations that support operating customers, such needs are typically framed in terms of response time.

We define ASRT as the time (in hours, days, or weeks) that the operating customer has specified as the requirement the distribution network must meet. It may be set by customer type, by material category, or by individual line item and it may change over time as operational requirements change. It may be established, used in network development and in performance measurement as a simple average, or it may be used in conjunction with process control systems to measure variances in addition to average levels. The concept is common to a diverse range of organizations: airlines, private-sector repair centers, power plants, commercial parts distribution organizations, the Department of Defense, the United States Postal Service, and commercial trucking companies, to name a few.

The important facets of ASRT are that it is specified by the customer in the customer's terms; it is the vital link between the customer and the logistician; and it

is used to design and evaluate the distribution system as a whole, having no direct relationship to any single element of the distribution system.

Relate Operational Goals to Network Support Goals

Once an overall support objective has been defined, network design becomes an analytical undertaking. We recognize that external or subjective factors must inevitably be accommodated in any final network decision and that networks, like other parts of any materials management strategy, must continue to change over time.

Translating operational goals, such as ASRT, to more common or more traditional network support goals requires an understanding of network alternatives, structure, and linkages. Consider, for example, the VA structure that is basically a two-echelon internal distribution network [the VA Medical Center (VAMC) warehouse and the "depot," which could be a VA depot or an external distributor] with extensive external direct support linkages. Assume in the example shown in Figure A-1 that we decide to support the customer using a combination of the VA distribution system (for 90 percent of the requirements), direct delivery from the Defense Logistics Agency (DLA) or General Services Administration (GSA) sources (for 1 percent of the requirements), and commercial direct vendor delivery (for 9 percent of the requirement). Then, given an ASRT goal of approximately 26 hours, one viable network structure would involve use of both levels of the VA system with related material fill rates and delay times (delivery times) as indicated in the figure. Although this particular network structure is consistent with the ASRT goal of 26 hours, it may not be the most cost-effective approach to providing this level of customer service. It simply illustrates how we may convert an operationally oriented goal (ASRT) into meaningful material management goals and how we could begin to evaluate alternative network structures.

Identify Network Alternatives Based on Combinations of Material Availability and Delay Times

A number of alternative network structures could probably provide the required ASRT. Some could involve stocking material at all levels in the internal distribution network, others could involve no internal material inventories at levels above the medical center warehouse, and yet others could involve direct delivery to the using customer. Further, alternatives may vary by customer or by material

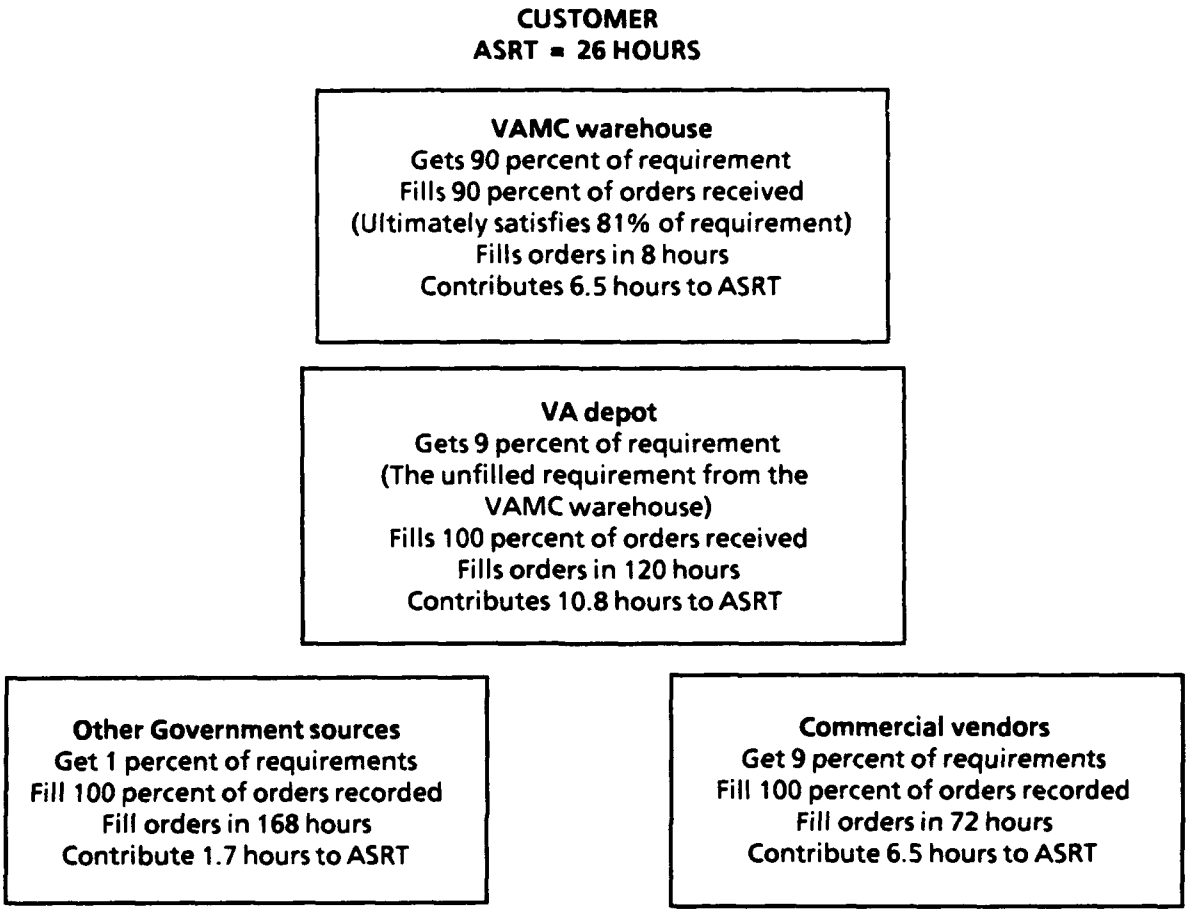

FIG. A-1. RELATING ASRT TO SPECIFIC MATERIAL MANAGEMENT GOALS

category. Material inventories positioned closer to the customer incur less delay in meeting the customer's requirement. However, based on the number of operating sites, the inventory investment may be prohibitive. Direct vendor support may be feasible for some material categories and not others, and some commodity groups may lend themselves to central stockage versus local stockage. Finally, ASRT service-level requirements may vary by type of material or customer.

Consider the illustration in Table A-1, which assumes three service levels: one for drugs and pharmaceuticals (ASRT of 24 hours), one for medical supplies (ASRT of 72 hours), and one for subsistence (ASRT of 120 hours). Given these differing ASRT requirements, a number of alternatives are still available to meet these service levels. Each alternative meets the ASRT requirement established by the customer.

However, the implications for network design and management are quite different. Some are inherently more inventory-intense than others, some incur higher material acquisition costs, and some require higher transportation costs. Moreover, VA operating costs (personnel, facilities, etc.) differ.

TABLE A-1

NETWORK DESIGN ALTERNATIVES

Commodity	Customer ASRT requirement	VAMC warehouse		VA depot		Commercial vendor	
		%	Hours	%	Hours	%	Hours
Drugs and pharmaceuticals	24 hours	80	1	100	115	–	–
	24 hours	80	1	90	72	100	160
	24 hours	90	1	–	–	100	230
Medical supplies	72 hours	70	1	80	60	100	325
	72 hours	90	1	–		100	72
	72 hours	–	–	80	60	100	120
Nonperishable subsistence items	120 hours	85	24	90	168	100	910
	120 hours	70	24	100	345	–	–
	120 hours	–	–	–	–	100	120

To facilitate more detailed analysis, however, it is important at this stage to identify a limited number of generic alternatives that appear to be capable of meeting the ASRT standards to be evaluated in our cost analysis. To narrow the alternatives, availability (or fill rates) and required delivery times for each alternative may be compared against current network performance to determine what is practical and feasible. In some cases, the ASRT itself may rule out specific network alternatives regardless of cost. This stage of alternative selection may be completed in a relatively short time period without the benefit of extensive data collection, without the use of a computer model, without making individual line-item decisions on inventory range and depth, and generally without outside assistance.

Select a Specific Network Structure Based on Cost Tradeoffs

Finally, for a given network alternative, different combinations of inventory range and depth costs, transportation times and costs, and material acquisition costs must be considered on the basis of the number and specific location of facilities. That cost analysis must be based on known operational data (demand densities by customer and/or geographical area; processing costs to receive, store, and issue material in VA storerooms, warehouses, and distribution centers; vendor material acquisition costs; purchase volumes; alternative costs for direct delivery; and transportation costs), spatial information (locations, distances, and times), facility data (overhead costs for VA or contract facilities), and inventory investment costs. To conduct this more-detailed cost analysis for a given network structure to meet an assigned ASRT, computer modeling is required. Modeling tends to be data-intensive and, as with most analytical efforts, the validity of the data will play a significant role in the success of the analysis.

APPENDIX B

STRATEGIC DISTRIBUTION TRENDS

STRATEGIC DISTRIBUTION TRENDS

EVOLVING DISTRIBUTION STRATEGIES

Effective long-term planning of physical distribution networks is important for any material management system. Distribution networks, including processing nodes, transportation links, and inventory represent the infrastructure used by the material management system to deliver responsive customer service. Regardless of the specific characteristics of a given distribution network, the following network design concepts introduced in Chapter 2 should be considered:

- Let service and cost factors dictate the specific design of the network
- Define network costs broadly and comprehensively
- Define network service requirements narrowly and specifically
- Hold material inventories as far up in the network as possible
- Maximize asset productivity
- Substitute information for other logistics resources (such as inventories, people, facilities, etc.) wherever possible
- Manage the network horizontally, not vertically, by focusing on flows rather than functions
- Establish long-term alliances with vendors and carriers wherever appropriate to share risk and reduce uncertainty
- Take advantage of volumes in material acquisition, storage, and movement.

BASIC NETWORK DESIGN TRENDS

While the specific approaches to network design differ depending on market and competitive factors, several overall trends in network design should be considered

when thinking about and planning distribution networks. These general trends include the following:

- The number of fixed warehouse facilities is generally being reduced. While national warehouse networks averaged approximately 17 facilities in the early 1980s (with many networks of 20 or 30 facilities), today most national warehousing networks have approximately 12 facilities and that national average is expected to decrease. The trend is a direct result of transportation market deregulation, particularly for motor freight and air cargo, which has increased the range of transportation services available, has spurred productivity improvements in transportation, and has reduced relative costs, particularly for large shippers where rate discounting by carriers is common.

- Those warehouses that are planned to become part of today's distribution networks are more often designed to deal efficiently with material movement (receiving, order processing, and shipping) rather than with material storage. The proliferation of automated storage and retrieval systems, including high-rise automated storage systems and carousels, has increased the emphasis placed on material identification and tracking, automated order flows, receiving and shipping dock automation, and on-line electronic ties to both customers and carriers.

- Many nondistribution firms, such as manufacturers and health care organizations, are relying increasingly on external commercial sources for distribution services, including both warehousing and transportation. This is essentially a question of organizational focus. Many nondistribution firms have concluded that internal resources should be directed to what the firm does best. Use of contracted services in other areas (such as distribution) allows the firm to exploit the competence of other organizations, to exploit scale where it is a factor, to maintain flexibility, and to tailor distribution services more directly to the firm's requirements. Growth in so-called third-party service organizations has been particularly strong.

DISTRIBUTION TRENDS IN THE HEALTH CARE INDUSTRY

The health care industry has been characterized in the past by extremely conservative distribution networks that relied on high amounts of inventory to provide the reliability necessary to satisfy the life-or-death support needs of hospitals. Rising health care material costs; faster, more reliable computer and telecommunications systems; and lower transportation costs are rapidly changing the way hospitals meet their needs for drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items. Toda , hospitals are increasingly dependent on

distributors to provide "just-in-time" or more radical "stockless" support, allowing them to reduce the cost of their inventories and free space for other uses.

The traditional health care distribution system consists of several layers of supply inventory. In a typical hospital, supplies are held in multiple locations: the wards, central supply, and the supply warehouse. Distributors hold more inventory external to the hospital distribution network. Hospital material managers traditionally maintain about 30 to 45 days of supply to support daily operations, typically tying up over $1 million in capital. They expend additional resources in inventory carrying costs.

In large hospital systems still operating in a traditional fashion, supply programs are often centrally managed, but inventories are generally being reduced. For example, Humana, Inc., has set inventory level standards for the departments in its hospitals ranging from 10 days of supply in nursing stations and dietetics to 45 days in central supply and pharmacy. However, the typical Humana hospital currently maintains its inventory levels at about 14 percent below corporate standards. The trend in Humana is to reduce those levels further.

In more innovative just-in-time systems, distributors make frequent, usually weekly, deliveries to a hospital's warehouse. The hospital then distributes the material internally using its own distribution system. In stockless systems, distributors make daily or more frequent deliveries directly to the wards. The net result of both methods is lower inventory costs, more reliable support to providers, and the return of space formerly used for storage to revenue-generating programs.

We visited a stockless system at Vanderbilt University. There, the receiving operation and most of the warehouse have been essentially eliminated and replaced with a stockless system operated by Baxter Healthcare Corporation. Several years into its stockless program, Vanderbilt claims that it saves $25,000 a year in inventory holding costs and $750,000 in operating expenses. While it pays Baxter a 3 percent fee for its distribution services, Vanderbilt also receives a 4 percent rebate for promptly paying its bills from manufacturers.

New hospital-distributor relationships have proliferated for several reasons. Distributor fees, service times, and fill rates are frequently better than hospitals are able to provide for themselves. Supported by bar-coded bin tags, portable scanners, and sophisticated information systems, their systems are also considerably faster and

easier to use. The net result is a high level of trust among nurses, pharmacists, and other health care providers that have allowed hospitals to reduce inventories from 30 to 45 days to 7 to 10 days of supply on hand.

Hospitals that have converted to just-in-time or stockless systems have told us that they have had to change both their philosophies and the processes by which they meet their material needs. For their traditional dependency on stocked inventory, they have substituted dependencies on information systems, contracting, and third-party distributors. Customers have adapted slowly, only gradually changing their habits. In the early stages of transition, for instance, nurses and pharmacists resisted reducing their inventories for fear of running out of supplies. Only after distributors proved responsive and reliable have those inventories been reduced. Moreover, the traditional mistrust of distributors has changed. With only a few days' stock on the shelf, and virtually no supply expertise of its own, the hospital must have a close and trusting partnership with its vendors and must depend upon that vendor to resolve problems. Such relationships have been made possible by long-term contracts that provide considerable motivation for the vendor to act in the hospital's best interest.

While the trends noted above are common to most of the commodities hospitals purchase, some differences exist in distribution methods in the drug and pharmaceutical, medical supply, and food service industries. For drugs and pharmaceuticals, direct delivery from distributors to hospital pharmacies, chain drug stores, and independent drug stores accounts for 85 percent of the nationwide market. Increasingly, hospitals and pharmacists negotiate drug prices directly with manufacturers and then pay a service fee to a primary distributor (or Prime Vendor contractor) to deliver the drugs to their facilities.[1] In 1990, over 80 percent of private hospital purchases for drugs were through wholesalers, and that figure has since risen.[2]

Medical supplies are distributed in much the same way. As more hospitals move toward just-in-time and stockless inventory systems, they become more

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[1]Prime Vendor is an on-demand, on-line ordering system available at some VAMCs to enable them to order a predefined range of drugs and pharmaceuticals and have them delivered directly from specified distributors within 1 day. These orders by-pass the VAMC warehouse and the VA depot.

[2]Interview: National Wholesale Druggists Association.

dependent on a single distributor for replenishing stock. Vanderbilt's relationship with Baxter is just one example.

The food service industry has a few national distributors, such as Houston-based SYSCO and Kraft. Unlike pharmaceutical and medical supply distributors, however, most food distributors are regional companies. They service restaurants, grocery stores, schools, and institutions other than hospitals in limited, but highly concentrated geographic areas. Most private hospitals manage food items separately from pharmaceutical and medical supplies, and movement toward just-in-time or stockless systems is less evident. The frequency of ordering food items in private hospitals is typically a function of the storage space available.

In summary, the health care industry still has a number of traditional supply networks even in for-profit hospital systems although inventories in hospitals are generally being reduced. More innovative programs that rely on distributors to hold virtually all inventory are becoming commonplace. Drugs and pharmaceuticals and medical supplies have sophisticated national distribution companies; food service distribution is typically more regional.

APPENDIX C

DISTRIBUTION NETWORK ALTERNATIVES

DISTRIBUTION NETWORK ALTERNATIVES

OVERVIEW

This appendix describes the material distribution network alternatives we considered. It consists of material from our June 1992 interim report and explains and compares six different approaches for distributing supplies to medical center customers. The purpose of the interim report was to identify the alternatives with the highest potential for success both from our perspective and that of the management of the Department of Veterans Affairs (VA) so that we could focus our detailed analysis on fewer alternatives. In this appendix, the alternatives are described in their "pure" form; that is, no mixtures of direct and depot support are discussed. In the subsequent modeling, however (described in Chapter 3), most of the alternatives were considered under various levels of direct support.

In this appendix, we identify those most attractive distribution network alternatives to be modeled in detail, and the our comparisons are largely qualitative. Some aggregate financial data are used to frame the range of potential benefits, and costs and staffing estimates have been included for direct labor requirements. However, no individual line-item data are used in our analysis. Initially, we made all comparisons relative to the baseline distribution system described in Chapter 2. Once the alternative is defined and described and its related benefits and costs established, we present an overall net assessment for the alternative relative to the baseline and the other alternatives. Summary descriptions of the alternatives are presented in Table C-1. Tables C-2 and C-3 compare the alternative distribution system performance and cost, respectively.

STRATEGIC DISTRIBUTION ALTERNATIVES

Alternative 1: Consolidated Depot Support with Regional Storage Points

Structure

As seen in Table C-1, Alternative 1 represents a major restructuring of the current VA depot system into a single, large, consolidated "super" depot as the major processing and storage point in the network. The super depot would serve to resupply

TABLE C-1

DISTRIBUTION SYSTEM ALTERNATIVES

Evaluation factor	Alternative					
	1 Super site with regional depots	2 Super site RDCs	3 Regional supply depots	4 VAMC warehouse support	5 RDCs	6 Direct vendor support
Number inventory levels	2	1/2	1	1	1/0	0
VAMC warehouse	No	No	No	Yes	No	No
Inventory funding	Depot-SF	Depot-SF	Depot-SF	VAMC-OP	Depot-SF	NA
Centralized contracts (local delivery)	No	No	No	Yes	Yes	Yes

Note: VAMC = VA Medical Center; SF = supply fund; OP = operating fund; RDCs = regional distribution centers.

TABLE C-2

COMPARISON OF DISTRIBUTION SYSTEM ALTERNATIVES

Evaluation factor	Alternative					
	1	2	3	4	5	6
Response time	Longer	Longer	Shorter	Much shorter	Shorter	Shorter
Flexibility	Less	Less	More	More	More	More
Management control	More	More	Same	Less	Less	Less
Contract workload	More	Less	Same	More	Much more	Much more
VAMC workload	Same	Same	Same	More	Much more	Much more

Note: All comparisons are relative to the baseline VA distribution system.

six to eight smaller regional depots, which would stock a matching range of material (in more limited depth) to support a distinct geographic customer base. It would also serve as the single delivery point to receive vendor deliveries to the VA depot system. This alternative would have no VAMC warehouse; however, some auxiliary storage of service inventories (particu..rly nonperishable subsistence items) might be required at the VAMC. We envisage the consolidated depot (which would probably be centrally located, perhaps at Hines, Ill.) as a full-service depot that would stock a

TABLE C-3

COST COMPARISON OF DISTRIBUTION SYSTEM ALTERNATIVES

Evaluation factor	Alternative					
	1	2	3	4	5	6
Inbound transportation $	More	Less	More	Much more	Much more	Much more
Outbound transportation $	Less	More	Less	None	Much less	None
Depot direct labor $	More	Less	More	None	Much less	None
VAMC direct labor $	Less	Same	Same	More	Less	Less
Depot overhead $	Less	Less	Same	More	Less	Less
VAMC overhead $	Less	Same	Same	More	Less	Less
Depot inventory $	More	Less	More	None	Much less	None
VAMC inventory $	Less	Same	Same	More	Less	Less
Delivered materiel cost	More	Less	More	Unknown	Less	Unknown

Note: All comparisons are relative to the baseline VA distribution system.

range of perhaps 3,500 to 5,000 line items in all material commodities with an inventory depth of approximately 45 to 60 days of material. No Prime Vendor contracting nor other direct vendor support should be necessary except for a limited range of locally purchased or Federal Supply Schedule (FSS)-supplied items that do not meet the stockage criteria based on demand frequency although the alternative can be modeled with various levels of direct support. The consolidated depot would have a storage and processing capacity of about 3.3 million gross square feet (GSF) and a staff of approximately 300 direct labor employees. Personnel requirements are far higher than the total currently allocated to the warehousing functions at Bell, Cal.; Hines, Ill.; and Somerville, N.J.

Regional storage points (located, for example, in Los Angeles, San Francisco, Seattle, Denver, Dallas, Atlanta, Richmond, and Somerville) would stock approximately 30 days of material and would be resupplied from the consolidated depot using the distribution requirements planning (DRP) capabilities available in the Integrated Supply Management System (ISMS). A single-system safety level and system reorder level would be utilized for depot stocks, and cross-servicing would be common under this alternative. Designed to serve about 15 to 20 VAMCs, these

regional storage points would issue and deliver directly to VAMC services using a "pull as required" ordering system linking the customer and the central inventory management system, presumably ISMS. Each of the regional storage depots would be about 200,000 GSF and would have a staffing level of about 40 direct labor employees.

To meet the established average system response time (ASRT) standards outlined in Table 2-5, the distribution source must meet fill rates and delivery times shown in Table C-4.

TABLE C-4

ALTERNATIVE 1 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
Regional storage point to customer	Drugs and pharmaceuticals	85 percent in 72 hours
	Medical supplies	70 percent in 120 hours
	Nonperishable subsistence items	85 percent in 120 hours
Consolidated depot to customer	Drugs and pharmaceuticals	90 percent in 240 hours 100 percent in 720 hours
	Medical supplies	85 percent in 240 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	90 percent in 240 hours 100 percent in 720 hours

Benefits

The primary benefit of this alternative is the elimination of VAMC warehouse inventories and operations with a related one-time saving of approximately $70 million in material and a continuing annual savings of about $7 million in inventory holding costs. While some reduction in VAMC facility costs (in space, maintenance, and energy for example) would be possible, we assumed in our analysis that the VAMC warehouse would be used for some local VAMC purpose and that no such savings would be realized. However, the elimination of VAMC warehousing

workload would free sufficient positions (estimated at about 10 per VAMC) to provide staffing for the 170 positions needed at the regional storage points in the network. Because the network is largely internal to the VA, control and management flexibility are greatest with this alternative. Further, by using a consolidated depot at the main storage site in the network, inbound transportation costs to the VA are minimized and centralized inventory management using ISMS DRP capabilities is feasible.

Costs

The primary disadvantages of this alternative compared to the other alternatives are related to inventory investment and distribution facilities requirements because this distribution network alternative results in more inventory and more facilities in the network. When compared with the baseline, an additional depot-level inventory investment of approximately $60 million is projected under this alternative. That increase is related to a substantial expansion in depot supply range and to a significant increase in total inventory depth in the network because of two echelons of depot stockage. Perhaps more significantly, lease or construction of six additional facilities, albeit smaller ones, would be required under this alternative. Including these added lease costs, depot operating costs (net of staffing) could increase by 40 percent to 50 percent over baseline depot costs. Further, staffing requirements at the consolidated depot are substantial. Finally, given the structure of the network, material would conceptually be handled (i.e., received, stored, and issued) twice: once at the consolidated depot and once at the regional storage point.

Net Assessment

On balance, we believe that network Alternative 1, while perhaps no more costly than current baseline operations, is the least attractive alternative identified. Given the substantial commitment of semifixed costs (of facilities, equipment, and inventories) required to establish the network initially and the continuing costs of inventory investment and material handling, we recommend against further consideration of this alternative.

Alternative 2: Super Depot with Regional Distribution Centers

Structure

As shown in Table C-1, Alternative 2 consists of a single, large, consolidated "super depot" as the major processing center and single storage point in the network. This consolidated depot would be approximately 3.3 million GSF with a staffing level of about 350 direct labor employees. As with Alternative 1, no Prime Vendor contracting nor other direct vendor support should be needed except for a limited range of locally purchased or FSS-supplied items that do not meet the stockage criteria based on demand frequency. The alternative can be modeled, however, with different levels of direct vendor support. We envisage that the depot inventory investment under this alternative (approximately $100 million) would be roughly 45 percent higher than baseline depot inventory investment, but almost $30 million less than the investment in depot inventories required under Alternative 1. The consolidated depot would serve VAMC customers directly through roughly 10 to 12 regional distribution centers[1] that would provide break bulk and delivery services to a predefined VAMC user base. Apart from a limited range of nonperishable subsistence items, the RDCs would have no storage mission but would be managed using the warehouse workload planning and transportation scheduling capabilities of the DRP module available in ISMS. Regional distribution centers would be small facilities, with about 10,000 GSF of processing/storage space and a staffing level of 5 to 10 direct labor employees. These regional distribution centers (ideally sited within 250 miles of the supported VAMCs) would serve about 10 to 15 medical centers; could be located in Los Angeles, San Francisco, Seattle, Denver, Dallas, Memphis, Atlanta, Jacksonville, Richmond, Cleveland, Somerville, and Boston; and their primary purpose would be to reduce the transportation costs associated with shipping directly from the consolidated depot to each customer. Table C-5 shows the fill rates and delivery times that the distribution source must meet to fulfill the proposed ASRT standards outlined in Table 2-5.

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[1]Because these RDCs are an integral part of the transportation and delivery process, the VA would need more of them (positioned near the medical centers) than it would regional depots in Alternative 1.

TABLE C-5

ALTERNATIVE 2 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
RDC to customer	Drugs and pharmaceuticals	NA
	Medical supplies	NA
	Nonperishable subsistence items	10 percent in 72 hours
Consolidated depot to customer	Drugs and pharmaceuticals	95 percent in 72 hours 100 percent in 720 hours
	Medical supplies	85 percent in 120 hours 100 percent in 720 hours
	Nonperishable subsistence items	65 percent in 72 hours 100 percent in 720 hours

Benefits

The primary benefit of this alternative is the elimination of VAMC warehouse inventories and operations with a related one-time saving of approximately $70 million in material and a continuing annual savings of about $7 million in inventory holding costs. As with Alternative 1, the associated reduction in VAMC facility costs would probably be used for other purposes with no net savings. The elimination of VAMC warehousing workload would free sufficient positions (estimated at about 10 per VAMC) to provide the staffing needed for the RDCs in the network. Further, because of the limited inventory investment at RDCs, this alternative is much less costly, involves less material handling, requires smaller facilities than Alternative 1, and enjoys most of the inbound transportation cost savings achievable in that alternative.

Costs

Relative to the baseline distribution network, the primary disadvantage of this alternative is higher internal transportation costs (i.e., outbound from the consolidated depot) for processing deliveries to the RDCs and customers. Internal transportation costs would also be higher than those under Alternative 1. Facilities and operations costs are likely to be higher than those of the baseline with the

introduction of the RDCs into the network, but they should be less than those of Alternative 1.

Net Assessment

Compared with the baseline distribution system, this alternative offers the prospect of substantial savings in inventory investment and inbound transportation costs while maintaining centralized inventory management control. Further, the elimination of the VAMC warehouse may make it easier for the customer to do business and may increase the flexibility and information flow in the system, allowing better, more timely status of material orders. Finally, this alternative is clearly superior to Alternative 1 in inventory investment, material handling workload, and facilities investment. Thus, we recommend that Alternative 2 be considered as an alternative to the current VA distribution network.

Alternative 3: Regional Depot

Structure

Alternative 3 decentralizes the current three-site VA depot network and establishes a decentralized network of approximately six to eight regional depots, each servicing 20 to 30 medical centers. While inventory management would continue to be centralized under this alternative, each regional depot would be managed as a separate, stand-alone storage facility with its own fill rate and delivery time goals, safety level, and reorder point. Regional depots (located, for example, in Los Angeles, San Francisco, Denver, Hines, Dallas, Atlanta, Richmond, and Somerville) would stock approximately 60 days of material using the DRP capabilities available in ISMS. Regional depot inventory stocks would be in the 3,500 to 5,000 line-item range. Prime Vendor contracting or other direct vendor support could be used for a limited range of locally purchased or FSS-supplied items that do not meet the stockage criteria based on demand frequency or could be modeled at higher levels. We envisage that the depot inventory investment under this alternative (approximately $120 million) would be roughly double the baseline depot inventory investment but $10 million less than the investment in depot inventories required under Alternative 1. The regional depots would serve assigned customers directly using a "pull as required" ordering system linking the customer and the central inventory management system, presumably ISMS. Each of the regional storage depots would be about 400,000 GSF and would have a staffing level of about 40 direct labor

employees. Cross-servicing between regional depots would be limited to emergency requirements.

To meet the ASRT standards proposed in Table 2-5, the regional depots must meet the fill rates and delivery times shown in Table C-6.

TABLE C-6

ALTERNATIVE 3 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
Regional depot to customer	Drugs and pharmaceuticals	90 percent in 72 hours 100 percent in 360 hours
	Medical supplies	90 percent in 72 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	90 percent in 72 hours 100 percent in 720 hours

Benefits

The primary benefit of this alternative is the elimination of VAMC warehouse inventories and operations with a related one-time saving of approximately $70 million in material and a continuing annual savings of about $7 million in inventory holding costs. Since the space saved in the VAMC warehouses would likely be used for some local VAMC purpose, no net facilities savings would be realized. The elimination of VAMC warehousing workload would provide the staffing needed for the RDCs in the network.

Costs

A more distributed depot system, as envisaged in Alternative 3, would be far more inventory-intense at the depot level than baseline operations are, particularly given the expanded range expected for the regional depot network. With respect to transportation costs, internal (outbound) costs from the regional depots should be roughly equivalent to those same costs in the baseline depot system. Inbound transportation costs from vendors may be somewhat higher than in the baseline since deliveries would be made directly to six to eight processing points versus the current three depots. While some current VA vendors may already have regional distri-

bution capabilities in areas where the regional VA depots would be located, it is unlikely that such is the case for all items and all vendors. Further, total facility costs (including staffing, maintenance, and energy) for the six or eight smaller facilities would be higher than baseline levels. Finally, this alternative would require the initial establishment of three to five additional depots, under lease or other arrangements.

Net Assessment

In many respects this alternative is preferable to Alternative 1; however, it appears to be at least as costly as the baseline depot distribution system. It seems less desirable than Alternative 2 based on its inventory investment costs and total facilities costs, and it is roughly equivalent to Alternative 2 in terms of outbound transportation costs even though inbound transportation costs would be higher. It should be compared more accurately to the other alternatives.

Alternative 4: VAMC Warehouse Support

Structure

Distribution network Alternative 4 relies heavily on the existing VAMC warehouse structure as the primary level of support to customers. Daily delivery of drugs and medical supplies and every-other-day delivery of subsistence items would be necessary under this alternative to meet proposed ASRT standards. Items not available in stock in the VAMC warehouse would be procured locally either under centrally negotiated instruments, including FSS, or under local purchase procedures. Without any depot level of support and with the customers relying heavily on responsive support from the VAMC warehouse, VAMC warehousing operations would become more labor-intensive but not more space-intensive under this alternative. We estimate that VAMC warehouse staffing would need to be augmented by approximately 10 percent to 20 percent (an average of 2 positions per medical center) to provide the increased level of responsiveness. This added staffing requirement could be met, in large part, from the elimination of approximately 100 depot warehousing and inventory management positions at Hines, Bell, and Somerville.

Table C-7 shows the fill rates and delivery times that would be needed under this alternative to meet the ASRT standards proposed in Table 2-5.

TABLE C-7

ALTERNATIVE 4 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
VAMC warehouse to customer	Drugs and pharmaceuticals	90 percent in 24 hours 100 percent in 720 hours
	Medical supplies	85 percent in 24 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	85 percent in 48 hours 100 percent in 720 hours

Benefits

The primary benefit of this distribution alternative is the elimination of the current investment in VA depot inventories. That elimination represents a one-time savings of $66 million and a continuing annual savings of about $6 million in inventory holding costs. To compensate for longer delivery lead times (the VAMC warehouse inventories are assumed to roughly double), an offsetting additional one-time lay-in cost $10 million for additional VAMC warehouse safety levels and a continuing annual additional cost of about $1 million would be incurred. Thus, the net savings in inventory investment would be a one-time savings of about $56 million and an annual savings of roughly $5 million in holding costs. Furthermore, this alternative would essentially eliminate a large portion of current depot operations costs, including depot warehouse operations and centralized inventory management costs.

Costs

Two primary costs are associated with Alternative 4. First, inventory management in this system is totally decentralized with potential problems of cost, control, and consistency in management effectiveness. Second, inbound transportation costs, including material handling and delivery, from the manufacturer or distributor to 170 individual medical center delivery points are likely to be substantially higher than baseline inbound transportation costs, particularly for those current VA vendors who do not have a decentralized distribution capability to service individual VAMCs.

Net Assessment

In retaining the existing VAMC warehouse system augmented by higher warehouse safety levels to compensate for slightly longer lead times, we lose the opportunity to make a substantial reduction in material inventories on site, where service inventories already exist in a depth adequate to support the medical center from more efficient off-site sources. Inventory savings at the depot level under this alternative are partially offset by increases in the inventory at VAMC warehouses, making Alternative 4 relatively less attractive than some other alternatives. In addition, VAMC warehouse staffing would have to be increased to meet required issue and delivery time frames. However, the most important factors are the level of consistency and management expertise that can reasonably be expected at the medical center level, the relatively cumbersome nature and inflexibility of the current VAMC distribution system in the VAMC, and competing priorities within the VAMC. For all these reasons, we recommend against further consideration of Alternative 4.

Alternative 5: Direct Support with RDCs

Structure

Alternative 5 combines direct vendor delivery with VA-operated RDCs. This alternative would rely on direct vendor support to customers whenever the commodity demand, price, and transportation and material handling economics permit. It would retain the flexibility of in-house processing capabilities for selected items or for commodity groups or as a secondary source of supply to minimize the risks associated with a heavy reliance on direct support arrangements. Under Alternative 5, we envisage that almost all drugs and pharmaceuticals, most medical supplies, and perhaps some low-bulk subsistence items would receive some form of direct support (Prime Vendor containing, FSS, local purchase). If vendor costs are prohibitive in selected situations, under this arrangement material could be delivered through a network of roughly 10 to 12 RDCs that would provide break-bulk and delivery services to a distinct VAMC user base. Where the economics of transportation and material handling and delivery dictate, the vendor would deliver customer orders to the designated RDC serving a VAMC for further delivery to the customer. For a limited range of unique drugs and pharmaceuticals, medical supplies, and some high-bulk nonperishable subsistence items, the RDCs would also

have a storage mission. Regional distribution centers would be small facilities, with about 30,000 GSF of processing/storage space and a staffing level of 5 to 10. These RDCs (ideally sited within 250 miles of the VAMCs they support) would serve about 10 to 15 VAMCs could be located in Los Angeles, San Francisco, Seattle, Denver, Dallas, Memphis, Atlanta, Jacksonville, Richmond, Cleveland, Somerville, and Boston; and would primarily reduce the transportation costs associated with shipping directly from the vendor to each VAMC customer.

Table C-8 shows fill rates and delivery times that would be needed to meet the ASRT standards proposed in Table 2-5 under the alternative.

TABLE C-8

ALTERNATIVE 5 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
Vendor to customer	Drugs and pharmaceuticals	90 percent in 72 hours 100 percent in 720 hours
	Medical supplies	80 percent in 72 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	NA
RDC to customer	Drugs and pharmaceuticals	10 percent in 72 hours 100 percent in 720 hours
	Medical supplies	20 percent in 72 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	95 percent in 72 hours 100 percent in 1,440 hours

Benefits

Alternative 5 drastically reduces the VA investment in material inventories. Its primary benefit is the elimination of VAMC warehouse inventories and operations, which saves approximately $70 million in material and provide annual savings of about $7 million in inventory holding costs. Although some facilities savings are likely, the vacated facilities would probably be used for some local VAMC purpose. The elimination of VAMC warehousing workload would provide enough positions to staff the RDCs and the expanded National Acquisition Center (NAC) operation that would be needed to negotiate and administer a larger volume of direct support

contracts. Another major benefit of this distribution alternative is that it would eliminate the current investment in VA depot inventories. That investment represents a one-time savings of $66 million and a continuing annual savings of about $6 million in inventory holding costs. Furthermore, depot operating costs would decrease as the result of decreases in personnel staffing and facilities, maintenance, and energy costs associated with the current VA depot operation.

In total, apart from any operational cost savings, this alternative would yield savings of roughly $13 million a year in inventory holding costs alone. A major positive aspect of this distribution alternative is its flexibility. It will allow the VA to react to support requirements and market conditions over time. The regional distribution centers will allow the VA to determine the sources of individual items separately (i.e., direct vendor support to the customer, vendor support to the customer through the RDC, or customer support through RDC stockage) on the basis of market conditions, the item, and the transportation/handling economics involved.

Costs

This alternative has two major disadvantages. First, delivered material costs under direct vendor support arrangements are likely to be higher than current depot material acquisition costs, and for some of those limited items stocked at RDCs, material costs may actually be higher than costs from the VA depot baseline. Based on our discussions with a number of distributors, vendor markup for items delivered directly to VAMC services may be expected to range from 1 percent to 5 percent of the manufacturer's cost, depending on the specific items included and the service level requirements established. Overall, this appears to be competitive with the existing VA depot markup, but it must be evaluated completely. Second, this distribution alternative imposes substantial workload impacts, both in the depth and scope of the involvement of procurement professionals at both the VA's NAC and the local VAMC. This additional workload must be absorbed through the personnel savings generated in warehousing and inventory management at the depots and in the individual VAMCs.

Net Assessment

Given the large inventory savings, the overall flexibility, and the responsiveness inherent in the use of RDCs, we recommend that this alternative be evaluated more fully relative to the baseline distribution system.

Alternative 6: Direct Support

Structure

Distribution Alternative 6 relies exclusively on direct vendor support to the VAMC customer. Such direct support might consist of Prime Vendor contractual arrangements (extended to drugs and pharmaceuticals in general, to medical supplies where feasible, and to nonperishable subsistence items), FSS support, or local purchase support. In this distribution structure, the VA distribution system (as we have defined it) has no material inventories and the only inventory is held by the VAMC customer. Not only is the VAMC warehouse eliminated entirely as an inventory level, but the VA depot system is also eliminated. If the VA is to operate in this just-in-time (JIT) environment, the NAC will become critical to viable material sourcing, vendor evaluation, and contract negotiation. Alternative 6 would necessitate increases in the quantity and quality of staffing at the center. However, given the positions saved at the VAMCs (approximately 170) and in the depots (approximately 75), such a staffing increase is feasible with a potential for a net position saving. For those items not supported under some sort of central or national contracting vehicles, the ability of the VAMC A&MM Service to locally procure these items quickly and at a reasonable cost is also vital to the effectiveness of this support system. Thus, this alternative is highly contracting-intense and, essentially, VAMC support rests on the ability of the system to develop and maintain viable, long-term vendor relationships at a reasonable cost over time.

The fill rates and delivery times needed under this alternative to meet ASRT standards proposed in Table 2-5 are shown in Table C-9.

Benefits

Alternative 6 – more than any other – minimizes VA's investment in material inventories. Elimination of VAMC warehouse inventories and operations would produce a one-time saving of approximately $70 million in material and a continuing annual saving of about $7 million in inventory holding costs. Additionally, elimina-

TABLE C-9

ALTERNATIVE 6 FILL RATES AND DELIVERY TIMES NEEDED TO MEET ASRT STANDARDS

Distribution source	Commodity	Fill rate/delivery time
Vendor to customer	Drugs and pharmaceuticals	95 percent in 72 hours 100 percent in 720 hours
	Medical supplies	90 percent in 72 hours 100 percent in 1,440 hours
	Nonperishable subsistence items	90 percent in 72 hours 100 percent in 960 hours

tion of the current investment in VA depot inventories would produce a one-time saving of $66 million and a continuing annual saving of about $6 million in inventory holding costs. The elimination of warehousing workloads at both levels would free sufficient positions to provide about 245 people to staff both an expanded VAMC A&MM Service local purchasing operation and an expanded NAC operation. Further, depot operating costs would decrease through decreases in personnel staffing and facilities, maintenance, and energy costs associated with the current VA depot operation.

In total, apart from any operational cost savings, this alternative would yield savings of roughly $13 million per year in inventory holding costs alone. While appreciable, that saving represents less than 1 percent of total annual VAMC expenditures on drugs and pharmaceuticals, medical supplies, and nonperishable subsistence items.

Costs

Alternative 6 suffers from three major disadvantages. First, delivered material costs under these direct vendor support arrangements are likely to be higher than current depot material acquisition costs. They may even be higher than current delivered material costs from the VA depot on selected items. The vendor markup of from 1 percent to 5 percent of the manufacturer's cost appears to be competitive with the existing VA depot markup, but it needs further evaluation. Second, Alternative 6 imposes substantial additional workload in the depth and scope of involvement of procurement professionals both at the NAC and the VAMC. Third, once the internal

VA distribution infrastructure is eliminated (including depots and inventory management capabilities), the VA will face obvious cost risks in maintaining these direct vendor support arrangements over time without an adequate level of competition in the market.

Net Assessment

In spite of the risks associated with a distribution network that relies exclusively on external vendor support, we recommend that this alternative be considered in greater detail based on the substantial potential inventory, facility, and operating cost savings associated with this approach.

SUMMARY OF ALTERNATIVE DISTRIBUTION STRATEGIES

Table C-10 consolidates much of our analysis. Cost projections are based on aggregate financial data only and should be viewed as preliminary. As a group, we believe the distribution strategies profiled in Table C-10 provide the VA a full range of alternatives for further analysis. On balance, we believe that, while all alternatives offer some prospect for improved service at potentially lower cost, some of the distribution strategies identified stand out in relation to the others as particularly attractive. We discuss those alternatives further in Chapter 3.

TABLE C-10

COMPARATIVE SUMMARY OF ALTERNATIVE DISTRIBUTION STRATEGIES

Alternative	1 Super site with RDs	2 Super site with RDCs	3 Regional supply depots	4 VAMC warehouse support	5 RDCs	6 Direct vendor support
Number of stockage locations	7 - 9	1	6 - 8	170	0	0
Line items stocked	3,500 to 5,000	3,500 to 5,000	3,500 to 5,000	1,000 to 1,5000	Less than 500	0
Staffing requirements	620	460	320	1,500	120	30 (Mktg. ctr.) 340 (VAMCs)
Facility size (thousands of GSF)						
Depot	3,000	3,000	0	Current VAMC warehouse space	0	N/A
RD	200	0	400	Current VAMC warehouse space	0	N/A
RDC	0	10	0	Current VAMC warehouse space	30	N/A
Inventory investment ($ millions)	$130	$100	$120	$100	$15	$0
Depot/RDC facility costs (baseline = 100)	150	130	110	0	25	0
Inbound transportation costs (baseline = 100)	80	70	110	130	120	140
Outbound transportation costs (baseline = 100)	90	120	80	20	60	0
Delivered material costs (baseline = 100)	120	90	110	90	80	75

Note: RD = regional depot.

APPENDIX D

MODELING DATA

MODELING DATA

Appendix D presents data used in our modeling efforts. It consists of seven charts with the following information:

- Transportation rates
- Warehouse storage and handling costs by facility location (pharmaceuticals)
- Warehouse storage and handling costs by facility location (medical supplies)
- Warehouse storage and handling costs by facility location (nonperishable subsistence items)
- VAMC throughput by complexity level
- Cost parameters
  - Percent volume by commodity group and channel for each case
  - Case-related variables
  - Commodity group-related variables
  - Other variables
- VAMC geographical locations.

These data were derived from various sources including commercial trucking companies, VA central office, VA medical centers, General Services Administration (GSA), and the Office of Management and Budget (OMB). The specific origin of each data element is described in Chapter 3.

TRANSPORTATION RATES USED IN NETWORK MODEL

Case	Ratio	FC - Drugs	VC - Drugs
Case 2-1 Depot	0.99	0.00251201	0.00000262
Case 2-2 Depot	0.86	0.00267189	0.00000275
Case 2-3 Depot	0.64	0.00302118	0.00000304
Case 2-1 RDCs	1.03	0.00246907	0.00000259
Case 2-2 RDCs	0.92	0.00259249	0.00000269
Case 2-3 RDCs	0.76	0.00282998	0.00000288
Case 3-1 Depot	1.01	0.00249043	0.00000260
Case 3-2 Depot	0.92	0.00259249	0.00000269
Case 3-3 Depot	0.76	0.00282998	0.00000288
Case 5-1 RDCs	0.72	0.00289325	0.00000293
Case 5-2 RDCs	0.48	0.00328854	0.00000327
Case 5-3 RDCs	0.26	0.00381670	0.00000378
Case B-1 Depot	1.00	0.00250144	0.00000261
Case B-2 Depot	0.25	0.00385571	0.00000382

Case	Ratio	FC - Med	VC - Med
Case 2-1 Depot	0.99	0.01078975	0.00001126
Case 2-2 Depot	0.86	0.01147647	0.00001183
Case 2-3 Depot	0.64	0.01297674	0.00001305
Case 2-1 RDCs	1.03	0.01060528	0.00001111
Case 2-2 RDCs	0.92	0.01113540	0.00001155
Case 2-3 RDCs	0.76	0.01215549	0.00001238
Case 3-1 Depot	1.01	0.01069705	0.00001118
Case 3-2 Depot	0.92	0.01113540	0.00001155
Case 3-3 Depot	0.76	0.01215549	0.00001238
Case 5-1 RDCs	0.72	0.01242727	0.00001259
Case 5-2 RDCs	0.48	0.01412513	0.00001405
Case 5-3 RDCs	0.26	0.01639370	0.00001625
Case B-1 Depot	1.00	0.01074432	0.00001122

Case	Ratio	FC - Sub	VC - Sub
Case 2-1 Depot	0.99	0.05761342	0.00006013
Case 2-2 Depot	0.86	0.06128028	0.00006317
Case 2-3 Depot	0.64	0.06929118	0.00006966
Case 2-1 RDCs	1.03	0.05662845	0.00005931
Case 2-2 RDCs	0.92	0.05945912	0.00006166
Case 2-3 RDCs	0.76	0.06490601	0.00006608
Case 3-1 Depot	1.01	0.05711848	0.00005972
Case 3-2 Depot	0.92	0.05945912	0.00006166
Case 3-3 Depot	0.76	0.06490601	0.00006608
Case 5-1 RDCs	0.72	0.06635723	0.00006725
Case 5-2 RDCs	0.48	0.07542317	0.00007502
Case 5-3 RDCs	0.26	0.08753657	0.00008675
Case B-1 Depot	1.00	0.05737084	0.00005993

Key: FC = Fixed Component expressed in dollars per dollar throughput

VC = Variable Component expressed in dollars per dollar throughput per mile shipped

Ratio = ratio of package sizes shipped to baseline package sizes shipped

Drugs = Pharmaceutical Items
Med = Medical Supply Items
Sub = Subsistence Items

Warehouse Storage and Handling Costs by Facility Location (Pharmaceuticals)

Fac No	Region	Location	Storage Costs	Handling Costs	Fixed Costs
1	4	ATLANTA GA	0.01913612	0.00662214	0
2	1	BOSTON MA	0.05117157	0.00662214	0
3	4	CHARLESTON SC	0.01913612	0.00662214	0
4	4	CHARLOTTE NC	0.01913612	0.00662214	0
5	5	CHICAGO IL	0.01465403	0.00662214	0
6	5	CLEVELAND OH	0.01465403	0.00662214	0
7	5	COLUMBUS OH	0.01465403	0.00662214	0
8	7	DALLAS TX	0.01129246	0.00662214	0
9	8	DENVER CO	0.01695254	0.00662214	0
10	7	HOUSTON TX	0.01129246	0.00662214	0
11	4	JACKSONVILLE FL	0.01913612	0.00662214	0
12	6	KANSAS CITY MO	0.02068761	0.00662214	0
13	9	LOS ANGELES CA	0.01686634	0.00662214	0
14	4	MEMPHIS TN	0.01913612	0.00662214	0
15	5	MILWAUKEE WI	0.01465403	0.00662214	0
16	5	MINEAPOLIS MN	0.01465403	0.00662214	0
17	4	ORLANDO FLA	0.01913612	0.00662214	0
18	9	PHOENIX AZ	0.01686634	0.00662214	0
19	3	PITTSBURGH PA	0.02166448	0.00662214	0
20	10	PORTLAND OR	0.01761336	0.00662214	0
21	3	RICHMOND VA	0.02166448	0.00662214	0
22	7	SAN ANTONIO	0.01129246	0.00662214	0
23	9	SAN FRAN CA	0.01686634	0.00662214	0
24	10	SEATTLE WA	0.01761336	0.00662214	0
25	2	SOMERVILLE NJ	0.01844657	0.00662214	0
26	10	BOISE ID	0.01761336	0.00662214	0
27	8	OGDEN UT	0.01695254	0.00662214	0
28	7	ALBUQUERQUE NM	0.01129246	0.00662214	0
		BASE - SVILLE	0.00089250	0.00547500	229476
		BASE - HINES	0.00353500	0.00662214	343590
		BASE - BELL	0.00073500	0.00808214	93953

Notes: (1) Storage costs reflect costs per inventory dollar
(2) Handling costs reflect costs per throughput dollar
(3) Fixed costs reflect fixed facility storage costs in dollars (applies to baseline cases only)

Warehouse Storage and Handling Costs by Facility Location (Medical Supplies)

Fac No	Region	Location	Storage Costs	Handling Costs	Fixed Costs
1	4	ATLANTA GA	0.50698290	0.03757521	0
2	1	BOSTON MA	1.35571425	0.03757521	0
3	4	CHARLESTON SC	0.50698290	0.03757521	0
4	4	CHARLOTTE NC	0.50698290	0.03757521	0
5	5	CHICAGO IL	0.38823664	0.03757521	0
6	5	CLEVELAND OH	0.38823664	0.03757521	0
7	5	COLUMBUS OH	0.38823664	0.03757521	0
8	7	DALLAS TX	0.29917693	0.03757521	0
9	8	DENVER CO	0.44913216	0.03757521	0
10	7	HOUSTON TX	0.29917693	0.03757521	0
11	4	JACKSONVILLE FL	0.50698290	0.03757521	0
12	6	KANSAS CITY MO	0.54808738	0.03757521	0
13	9	LOS ANGELES CA	0.44684858	0.03757521	0
14	4	MEMPHIS TN	0.50698290	0.03757521	0
15	5	MILWAUKEE WI	0.38823664	0.03757521	0
16	5	MINEAPOLIS MN	0.38823664	0.03757521	0
17	4	ORLANDO FLA	0.50698290	0.03757521	0
18	9	PHOENIX AZ	0.44684858	0.03757521	0
19	3	PITTSBURGH PA	0.57396798	0.03757521	0
20	10	PORTLAND OR	0.46663962	0.03757521	0
21	3	RICHMOND VA	0.57396798	0.03757521	0
22	7	SAN ANTONIO	0.29917693	0.03757521	0
23	9	SAN FRAN CA	0.44684858	0.03757521	0
24	10	SEATTLE WA	0.46663962	0.03757521	0
25	2	SOMERVILLE NJ	0.48871425	0.03757521	0
26	10	BOISE ID	0.46663962	0.03757521	0
27	8	OGDEN UT	0.44913216	0.03757521	0
28	7	ALBUQUERQUE NM	0.29917693	0.03757521	0
		BASE - SVILLE	0.02364545	0.03106612	875756
		BASE - HINES	0.09365455	0.03757521	1311252
		BASE - BELL	0.01947273	0.04585950	358557

Notes: (1) Storage costs reflect costs per inventory dollar
(2) Handling costs reflect costs per throughput dollar
(3) Fixed costs reflect fixed facility storage costs in dollars (applies to baseline cases only)

Warehouse Storage and Handling Costs by Facility Location (Subsistence)

Fac No	Region	Location	Storage Costs	Handling Costs	Fixed Costs
1	4	ATLANTA GA	0.81871749	0.06643077	0
2	1	BOSTON MA	2.18931833	0.06643077	0
3	4	CHARLESTON SC	0.81871749	0.06643077	0
4	4	CHARLOTTE NC	0.81871749	0.06643077	0
5	5	CHICAGO IL	0.62695630	0.06643077	0
6	5	CLEVELAND OH	0.62695630	0.06643077	0
7	5	COLUMBUS OH	0.62695630	0.06643077	0
8	7	DALLAS TX	0.48313540	0.06643077	0
9	8	DENVER CO	0.72529537	0.06643077	0
10	7	HOUSTON TX	0.48313540	0.06643077	0
11	4	JACKSONVILLE FL	0.81871749	0.06643077	0
12	6	KANSAS CITY MO	0.88509636	0.06643077	0
13	9	LOS ANGELES CA	0.72160765	0.06643077	0
14	4	MEMPHIS TN	0.81871749	0.06643077	0
15	5	MILWAUKEE WI	0.62695630	0.06643077	0
16	5	MINEAPOLIS MN	0.62695630	0.06643077	0
17	4	ORLANDO FLA	0.81871749	0.06643077	0
18	9	PHOENIX AZ	0.72160765	0.06643077	0
19	3	PITTSBURGH PA	0.92689047	0.06643077	0
20	10	PORTLAND OR	0.75356785	0.06643077	0
21	3	RICHMOND VA	0.92689047	0.06643077	0
22	7	SAN ANTONIO	0.48313540	0.06643077	0
23	9	SAN FRAN CA	0.72160765	0.06643077	0
24	10	SEATTLE WA	0.75356785	0.06643077	0
25	2	SOMERVILLE NJ	0.78921577	0.06643077	0
26	10	BOISE ID	0.75356785	0.06643077	0
27	8	OGDEN UT	0.72529537	0.06643077	0
28	7	ALBUQUERQUE NM	0.48313540	0.06643077	0
		BASE - SVILLE	0.03818462	0.05492308	455830
		BASE - HINES	0.15124103	0.06643077	682505
		BASE - BELL	0.03144615	0.08107692	186629

Notes: (1) Storage costs reflect costs per inventory dollar
(2) Handling costs reflect costs per throughput dollar
(3) Fixed costs reflect fixed facility storage costs in dollars (applies to baseline cases only)

VAMC Throughput by Complexity Level ($000)

VAMC Complexity	Drugs Total	Med Supp Total	Subsistence Total	Number Facilities
1	7810	5810	391	43
2	5433	2024	213	37
3	3661	1709	291	54
4	2137	693	117	31
Total for all VAMCs by Complexity				
1	335812	249817	16803	
2	201038	74884	7864	
3	197707	92302	15732	
4	66242	21468	3642	
Grand Total	800800	438471	44040	

VA Distribution Alternative Cost Parameters 08/18/92 at 13:29:04

Percent Volume by Commodity Group and Channel for Each Case

Comm	Channel	Case --> B-1	B-2	2-1	2-2	2-3	3-1	3-2	3-3	5-1	5-2	5-3	6-1
Drugs	Depot Direct	15.3	15.3	94.0	75.0	50.0	90.0	72.0	50.0	0.0	0.0	0.0	0.0
	RDC Direct	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	40.0	16.0	10.0	0.0
	Local Direct	30.3	30.3	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Prime Vendor	15.0	15.0	0.0	20.0	45.0	0.0	20.0	45.0	50.0	75.0	85.0	90.0
	Vend Direct	5.0	5.0	5.0	4.0	4.0	9.0	7.0	4.0	9.0	8.0	4.0	9.0
	Depot VAMC WH	13.0	13.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Local VAMC WH	21.4	21.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Med	Depot Direct	2.9	2.9	87.0	75.0	60.0	88.0	80.0	68.0	0.0	0.0	0.0	0.0
	RDC Direct	0.0	0.0	0.0	3.0	8.0	0.0	0.0	0.0	60.0	38.0	13.0	0.0
	Local Direct	60.1	60.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
	Prime Vendor	0.0	0.0	0.0	10.0	20.0	0.0	10.0	20.0	28.0	50.0	75.0	90.0
	Vend Direct	7.0	7.0	10.0	9.0	9.0	9.0	7.0	9.0	9.0	9.0	9.0	7.0
	Depot VAMC WH	7.2	7.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Local VAMC WH	22.8	22.8	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Sub	Depot Direct	24.9	24.9	85.0	80.0	55.0	93.0	93.0	78.0	0.0	0.0	0.0	0.0
	RDC Direct	0.0	0.0	10.0	14.0	24.0	0.0	0.0	0.0	91.0	71.0	52.0	0.0
	Local Direct	30.1	30.1	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
	Prime Vendor	0.0	0.0	0.0	0.0	15.0	0.0	0.0	15.0	0.0	20.0	40.0	93.0
	Vend Direct	12.0	12.0	4.0	5.0	5.0	6.0	6.0	6.0	8.0	8.0	7.0	6.0
	Depot VAMC WH	14.6	14.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Local VAMC WH	18.4	18.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Other Variables for Each Case

Variable	Case --> B-1	B-2	2-1	2-2	2-3	3-1	3-2	3-3	5-1	5-2	5-3	6-1
Inventory MOS - Depot	2.5	2.5	1.5	1.5	1.5	3.5	3.5	3.5	0.0	0.0	0.0	0.0
Inventory MOS - RDC	0.0	0.0	1.5	1.5	1.5	0.0	0.0	0.0	1.5	1.5	1.5	0.0
Cap Cost % - Depot	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
Cap Cost % - RDC/VAMC	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0
VAMC WH Storage Costs	33689	33689	0	0	0	0	0	0	0	0	0	0
VAMC WH Handling Costs	50403	50403	0	0	0	0	0	0	0	0	0	0
VAMC WH Inventory	65000	38641	0	0	0	0	0	0	0	0	0	0
NAC Staffing	110	110	120	125	130	120	125	130	125	135	150	175

Commodity Group Variables	Drugs	Med	Sub
Markup % - Depot Direct	0.0	0.0	0.0
Markup % - RDC Direct	2.0	3.0	5.0
Markup % - Local Direct	2.0	3.0	5.0
Markup % - Prime Vendor	2.0	3.0	5.0
Markup % - Vend Direct	2.0	3.0	5.0
Markup % - Depot VAMC WH	0.0	0.0	0.0
Markup % - Local VAMC WH	2.0	3.0	5.0
DL Pers per $000000 TP	0.154	0.872	1.541
BB Pers per $000000 TP	0.027	0.153	0.272
Square Feet per $000 Inv	2.442	64.701	104.485
BB Sqr Feet per $000 BB TP	0.018	0.482	0.779
Total Throughput in $000	800800	438471	44040

Other Variables NAC Personnel Cost = 42 Min RDC Staff = 3

VAMC Geographical Locations

Index	Facility No	City	State	Zip	USX	Site Complexity	Region	Longitude	Latitude
1	402	TOGUS	ME	04330	N	3	1	6977	4432
2	405	WHITE RIVER JUNCTIO	VT	05001	N	2	1	7298	4361
3	436	FORT HARRISON	MT	59636	N	4	3	11251	4600
4	437	FARGO	ND	58102	N	3	2	9679	4687
5	438	SIOUX FALLS	SD	57117	N	3	2	9670	4351
6	442	CHEYENNE	WY	82001	N	4	2	10481	4112
7	452	WICHITA	KS	67218	N	3	2	9720	3778
8	459	HONOLULU	HI	96850	N	4	3	11836	3408
9	460	WILMINGTON	DE	19805	N	3	1	7555	3975
10	500	ALBANY	NY	12208	N	1	1	7376	4268
11	501	ALBUQUERQUE	NM	87108	N	2	3	10665	3508
12	502	ALEXANDRIA	LA	71301	N	3	2	9247	3128
13	503	ALTOONA	PA	16603	N	4	1	7841	4051
14	504	AMARILLO	TX	79106	N	3	2	10187	3357
15	505	TACOMA	WA	98493	N	3	3	12233	4763
16	506	ANN ARBOR	MI	48105	N	1	2	8306	4236
17	508	DECATUR	GA	30033	N	1	1	8438	3375
18	509	AUGUSTA	GA	30910	N	2	1	8199	3347
19	512	BALTIMORE	MD	21218	N	2	1	7653	3923
20	513	BATAVIA	NY	14020	N	3	1	7885	4291
21	514	BATH	NY	14810	N	3	1	7592	4210
22	515	BATTLE CREEK	MI	49016	N	3	2	8556	4227
23	516	BAY PINES	FL	33504	N	2	1	8228	2790
24	517	BECKLEY	WV	25801	N	4	1	8163	3835
25	518	BEDFORD	MA	01730	N	3	1	7108	4231
26	519	BIG SPRING	TX	79720	N	4	2	10044	3145
27	520	BILOXI	MS	39531	N	3	2	9007	2996
28	521	BIRMINGHAM	AL	35233	N	1	2	8681	3352
29	522	BONHAM	TX	75418	Y	4	2	9678	3298
30	523	BOSTON	MA	02130	N	1	1	7108	4231
31	525	BROCKTON	MA	02401	N	1	1	7108	4231
32	526	BRONX	NY	10468	Y	2	1	7400	4072
33	527	BROOKLYN	NY	11209	Y	1	1	7400	4072
34	528	BUFFALO	NY	14215	N	1	1	7885	4291
35	529	BUTLER	PA	16001	N	4	1	7990	4037
36	531	BOISE	ID	83702	N	3	3	11621	4361
37	532	CANANDAIGUA	NY	14424	N	3	1	7761	4316
38	533	CASTLE POINT	NY	12511	Y	3	1	7400	4072
39	534	CHARLESTON	SC	29403	N	2	1	7990	3277
40	535	CHICAGO	IL	60611	Y	2	2	8764	4183
41	537	CHICAGO	IL	60680	Y	1	2	8764	4183
42	538	CHILLICOTHE	OH	45601	N	3	2	8166	4148
43	539	CINCINNATI	OH	45220	N	2	2	8451	3914
44	540	CLARKSBURG	WV	26301	N	4	1	8032	3927
45	541	CLEVELAND	OH	44141	N	1	2	8166	4148
46	542	COATESVILLE	PA	19320	Y	3	1	7517	3995
47	543	COLUMBIA	MO	65201	N	2	2	9221	3895
48	544	COLUMBIA	SC	29201	N	2	1	8100	3401
49	546	MIAMI	FL	33125	N	1	1	8028	2583
50	549	DALLAS	TX	75216	Y	1	2	9678	3298
51	550	DANVILLE	IL	61832	N	3	2	8960	4071
52	552	DAYTON	OH	45428	N	2	2	8451	3914
53	553	ALLEN PARK	MI	48101	N	2	2	8306	4236
54	554	DENVER	CO	80220	N	1	2	10498	3973

VAMC Geographical Locations

Index	Facility No	City	State	Zip	USX	Site Complexity	Region	Longitude	Latitude
55	555	DES MOINES	IA	50310	N	3	2	9372	4160
56	556	NORTH CHICAGO	IL	60064	Y	2	2	8764	4183
57	557	DUBLIN	GA	31021	N	3	1	8437	3375
58	558	DURHAM	NC	27705	N	2	1	7975	3605
59	561	EAST ORANGE	NJ	07019	Y	1	1	7400	4072
60	562	ERIE	PA	16501	N	3	1	8008	4212
61	564	FAYETTEVILLE	AR	72701	N	4	2	9439	3533
62	565	FAYETTEVILLE	NC	28301	N	3	1	7975	3605
63	566	FORT HOWARD	MD	21052	N	4	1	7653	3923
64	567	FT. LYON	CO	81038	N	4	2	10498	3973
65	568	FORT MEADE	SD	57741	N	4	2	10315	4410
66	569	FORT WAYNE	IN	46805	N	4	2	8515	4106
67	570	FRESNO	CA	93703	Y	2	3	11978	3676
68	573	GAINESVILLE	FL	32602	N	1	1	8165	3033
69	574	GRAND ISLAND	NE	68801	N	4	2	10077	4113
70	575	GRAND JUNCTION	CO	81501	N	3	3	10854	3905
71	578	HINES	IL	60141	Y	1	2	8764	4183
72	579	HOT SPRINGS	SD	57747	N	4	2	10315	4410
73	580	HOUSTON	TX	77211	N	1	2	9538	2978
74	581	HUNTINGTON	WV	25704	N	3	2	8163	3835
75	583	INDIANAPOLIS	IN	46207	N	1	2	8615	3976
76	584	IOWA CITY	IA	52240	N	2	2	9166	4198
77	585	IRON MOUNTAIN	MI	49801	N	4	2	8807	4580
78	586	JACKSON	MS	39216	N	2	2	9017	3231
79	589	KANSAS CITY	MO	64128	N	2	2	9458	3910
80	590	HAMPTON	VA	23667	N	2	1	7628	3685
81	591	KERRVILLE	TX	78028	N	4	2	9844	2959
82	592	KNOXVILLE	IA	50138	N	3	2	9372	4160
83	594	LAKE CITY	FL	32055	N	3	1	8165	3033
84	595	LEBANON	PA	17042	Y	3	1	7687	4027
85	596	LEXINGTON	KY	40507	N	1	2	8449	3805
86	597	LINCOLN	NE	68510	N	3	2	9601	4119
87	598	LITTLE ROCK	AR	72205	N	1	2	9232	3473
88	599	LIVERMORE	CA	94550	Y	3	3	12221	3778
89	600	LONG BEACH	CA	90822	N	1	3	11836	3408
90	603	LOUISVILLE	KY	40202	N	2	2	8587	3822
91	604	LYONS	NJ	07939	Y	3	1	7400	4072
92	605	LOMA LINDA	CA	92357	Y	2	3	11836	3408
93	607	MADISON	WI	53705	Y	2	2	8940	4306
94	608	MANCHESTER	NH	03103	N	3	1	7146	4298
95	609	MARION	IL	62959	N	3	2	8862	3705
96	610	MARION	IN	46952	N	3	2	8615	3976
97	611	MARLIN	TX	76661	Y	4	2	9715	3155
98	612	MARTINEZ	CA	94553	N	2	3	12221	3778
99	613	MARTINSBURG	WV	25401	N	3	1	7876	3965
100	614	MEMPHIS	TN	38104	N	1	2	8995	3910
101	617	MILES CITY	MT	59301	N	4	2	10868	4592
102	618	MINNEAPOLIS	MN	55417	N	1	2	9320	4492
103	619	MONTGOMERY	AL	36193	N	4	2	8629	3236
104	620	MONTROSE	NY	10548	Y	3	1	7400	4072
105	621	MOUNTAIN HOME	TN	37601	N	2	1	8254	3655
106	622	MURFREESBORO	TN	37130	N	3	2	8676	3616
107	623	MUSKOGEE	OK	74401	N	3	2	9753	3547
108	626	NASHVILLE	TN	37203	N	2	2	8676	3616

VAMC Geographical Locations

Index	Facility No	City	State	Zip	USX	Site Complexity	Region	Longitude	Latitude
109	627	NEWINGTON	CT	06111	N	2	1	7269	4176
110	629	NEW ORLEANS	LA	70146	N	1	2	9007	2996
111	630	NEW YORK	NY	10010	Y	1	1	7400	4072
112	631	NORTHAMPTON	MA	01060	N	3	1	7269	4176
113	632	NORTHPORT	NY	11768	Y	1	1	7400	4072
114	635	OKLAHOMA CITY	OK	73104	N	2	2	9753	3547
115	636	OMAHA	NE	68105	N	2	2	9601	4119
116	637	ASHEVILLE	NC	28805	N	3	1	8083	3521
117	640	PALO ALTO	CA	94304	N	1	3	12221	3778
118	641	PERRY POINT	MD	21902	N	3	1	7555	3975
119	642	PHILADELPHIA	PA	19104	Y	1	1	7517	3995
120	644	PHOENIX	AZ	85012	N	2	3	11208	3349
121	645	PITTSBURGH	PA	15206	N	3	1	7990	4037
122	646	PITTSBURGH	PA	15240	N	1	1	7990	4037
123	647	POPLAR BLUFF	MO	63901	N	4	2	9040	3676
124	648	PORTLAND	OR	97207	N	1	3	12267	4546
125	649	PRESCOTT	AZ	86301	N	4	3	11208	3349
126	650	PROVIDENCE	RI	02908	N	2	1	7143	4182
127	652	RICHMOND	VA	23249	N	1	1	7745	3755
128	653	ROSEBURG	OR	97470	N	3	3	12267	4546
129	654	RENO	NV	89520	Y	3	3	11981	3952
130	655	SAGINAW	MI	48602	N	4	2	8392	4341
131	656	ST. CLOUD	MN	56301	N	3	2	9320	4492
132	657	ST LOUIS	MO	63125	N	1	2	9019	3863
133	658	SALEM	VA	24153	N	2	1	7995	3727
134	659	SALISBURY	NC	28144	N	3	1	8083	3521
135	660	SALT LAKE CITY	UT	84148	N	1	3	11196	4122
136	662	SAN FRANCISCO	CA	94121	Y	1	3	12221	3778
137	663	SEATTLE	WA	98108	N	1	3	12233	4763
138	664	SAN DIEGO	CA	92161	Y	1	3	11705	3262
139	665	SEPULVEDA	CA	91343	N	1	3	11836	3408
140	666	SHERIDAN	WY	82801	N	4	2	10695	4479
141	667	SHREVEPORT	LA	71130	N	2	2	9376	3247
142	668	SPOKANE	WA	99208	N	3	3	11741	4767
143	670	SYRACUSE	NY	13210	N	2	1	7614	4304
144	671	SAN ANTONIO	TX	78285	Y	1	2	9844	2959
145	672	SAN JUAN	PR	00921	N	1	1	7400	4072
146	673	TAMPA	FL	33612	N	1	1	8228	2790
147	674	TEMPLE	TX	76501	Y	2	2	9715	3155
148	676	TOMAH	WI	54660	N	3	2	9125	4380
149	677	TOPEKA	KS	66622	N	3	2	9458	3910
150	678	TUCSON	AZ	85723	N	2	3	11208	3349
151	679	TUSCALOOSA	AL	35404	N	3	2	8681	3352
152	680	TUSKEGEE	AL	36083	N	3	2	8629	3236
153	685	WACO	TX	76711	Y	3	2	9715	3155
154	686	LEAVENWORTH	KS	66048	Y	3	2	9458	3910
155	687	WALLA WALLA	WA	99362	N	4	3	11833	4606
156	688	WASHINGTON	DC	20422	N	1	1	7700	3889
157	689	WEST HAVEN	CT	06516	N	2	1	7293	4131
158	691	LOS ANGELES	CA	90073	N	1	3	11836	3408
159	692	WHITE CITY	OR	97503	N	4	3	12175	4222
160	693	WILKES-BARRE	PA	18711	Y	3	1	7591	4124
161	695	MILWAUKEE	WI	53193	Y	1	2	8801	4312
162	752	LOS ANGELES	CA	90013	Y	4	3	11836	3408

VAMC Geographical Locations

Index	Facility No	City	State	Zip	USX Site	Complexity	Region	Longitude	Latitude
163	756	EL PASO	TX	79925	N	4	2	10648	3175
164	757	COLUMBUS	OH	43221	N	4	2	8300	3997
165	758	LAS VEGAS	NV	89102	Y	4	3	11512	3617

APPENDIX E

MODEL OUTPUT

MODEL OUTPUT

To model the VA distribution network, we used a combination of software developed especially for this project at LMI and a multi-echelon facility location planning software package called Network (version 5.0) produced by Ronald H. Ballou Inc. Appendix E presents output from our modeling efforts. It includes one to four pages for each case as follows:

- One page describing the costs of the case broken down by channel, commodity group, and cost category (i.e., warehousing, transportation, etc.)
- One page describing the cost and physical characteristics (square feet, number of direct labor employees) of each depot location by commodity group and the percentage of Department of Veterans Affairs (VA) Medical Centers (VAMCs) within specified mileage ranges from their serving depot
- Two pages describing the cost and physical characteristics of each regional distribution center (RDC) by commodity group and the percentage of VAMCs within specified mileage ranges from their serving RDC.

Cases without either depots or RDCs do not have the corresponding pages for those types of facilities. The last page of the modeling output contains a summary of the costs by category and commodity group for each case. It also shows total costs for each case with all the commodity groups combined.

Channel / Commodity Group Flow and Cost - Summary by Case 08/18/92 at 13:29:04

Case	Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
B-1	All Channels	Drugs	800800	16243	857	8971	11483	1540	39094	4.9%
B-1	All Channels	Med	438471	63630	709	2949	11826	1540	80653	18.4%
B-1	All Channels	Sub	44040	13854	1491	587	1332	1540	18804	42.7%
B-2	All Channels	Drugs	800800	16243	1286	7248	11483	1540	37800	4.7%
B-2	All Channels	Med	438471	63630	1069	2127	11826	1540	80192	18.3%
B-2	All Channels	Sub	44040	13854	2260	496	1332	1540	19482	44.2%
2-1	All Channels	Drugs	800800	6932	3775	9409	961	1680	22757	2.8%
2-1	All Channels	Med	438471	40466	8335	4768	1710	1680	56959	13.0%
2-1	All Channels	Sub	44040	7307	4600	523	330	1680	14440	32.8%
2-2	All Channels	Drugs	800800	5530	3181	7507	4004	1750	21973	2.7%
2-2	All Channels	Med	438471	36086	7775	4275	3289	1750	53175	12.1%
2-2	All Channels	Sub	44040	7189	4711	517	440	1750	14608	33.2%
2-3	All Channels	Drugs	800800	3687	2373	5005	8008	1820	20893	2.6%
2-3	All Channels	Med	438471	31124	7303	3727	5262	1820	49236	11.2%
2-3	All Channels	Sub	44040	5910	4115	435	991	1820	13271	30.1%
3-1	All Channels	Drugs	800800	8119	2329	21021	1602	1680	34751	4.3%
3-1	All Channels	Med	438471	56528	6581	11254	1578	1680	77622	17.7%
3-1	All Channels	Sub	44040	10616	3114	1195	154	1680	16759	38.1%
3-2	All Channels	Drugs	800800	6511	1931	16817	4484	1750	31493	3.9%
3-2	All Channels	Med	438471	51388	6213	10231	2631	1750	72213	16.5%
3-2	All Channels	Sub	44040	10628	3244	1195	154	1750	16970	38.5%
3-3	All Channels	Drugs	800800	4526	1459	11678	8008	1820	27491	3.4%
3-3	All Channels	Med	438471	43956	5596	8696	4209	1820	64278	14.7%
3-3	All Channels	Sub	44040	8934	2951	1002	484	1820	15192	34.5%
5-1	All Channels	Drugs	800800	2777	1112	4004	16016	1750	25659	3.2%
5-1	All Channels	Med	438471	24054	3917	3289	13154	1750	46164	10.5%
5-1	All Channels	Sub	44040	6140	3244	501	2202	1750	13837	31.4%
5-2	All Channels	Drugs	800800	1110	499	1602	16016	1890	21117	2.6%
5-2	All Channels	Med	438471	15237	2810	2083	13154	1890	35174	8.0%
5-2	All Channels	Sub	44040	4790	2861	391	2202	1890	12134	27.6%
5-3	All Channels	Drugs	800800	693	374	1001	16016	2100	20184	2.5%
5-3	All Channels	Med	438471	5207	1107	713	13154	2100	22281	5.1%
5-3	All Channels	Sub	44040	3514	2418	286	2202	2100	10520	23.9%
6-1	All Channels	Drugs	800800	0	0	0	16016	2450	18466	2.3%
6-1	All Channels	Med	438471	0	0	0	13154	2450	15604	3.6%
6-1	All Channels	Sub	44040	0	0	0	2202	2450	4652	10.6%
B-1	All Channels	All	1283311	93727	3057	12506	24641	4620	138552	10.8%
B-2	All Channels	All	1283311	93727	4615	9871	24641	4620	137474	10.7%
2-1	All Channels	All	1283311	54705	16710	14701	3001	5040	94157	7.3%
2-2	All Channels	All	1283311	48805	15667	12300	7733	5250	89755	7.0%
2-3	All Channels	All	1283311	40721	13791	9167	14261	5460	83399	6.5%
3-1	All Channels	All	1283311	75263	12024	33470	3334	5040	129131	10.1%
3-2	All Channels	All	1283311	68527	11388	28242	7269	5250	120676	9.4%
3-3	All Channels	All	1283311	57416	10006	21377	12702	5460	106960	8.3%
5-1	All Channels	All	1283311	32971	8273	7793	31372	5250	85660	6.7%
5-2	All Channels	All	1283311	21137	6170	4075	31372	5670	68424	5.3%
5-3	All Channels	All	1283311	9414	3899	2000	31372	6300	52985	4.1%
6-1	All Channels	All	1283311	0	0	0	31372	7350	38722	3.0%

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	122378	1200	463	2550	0	0	4212	3.4%
Depot Direct	Med	12843	1349	206	268	0	0	1822	14.2%
Depot Direct	Sub	10959	1739	939	228	0	0	2907	26.5%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	242642	0	0	0	4853	0	4853	2.0%
Local Direct	Med	263521	0	0	0	7906	0	7906	3.0%
Local Direct	Sub	13243	0	0	0	662	0	662	5.0%
Prime Vendor	Drugs	120120	0	0	0	2402	0	2402	2.0%
Prime Vendor	Med	0	0	0	0	0	0	0	0.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	40040	0	0	0	801	0	801	2.0%
Vend Direct	Med	30693	0	0	0	921	0	921	3.0%
Vend Direct	Sub	5285	0	0	0	264	0	264	5.0%
Depot VAMC WH	Drugs	104248	6325	394	3779	0	0	10499	10.1%
Depot VAMC WH	Med	31443	17414	503	1140	0	0	19058	60.6%
Depot VAMC WH	Sub	6436	5928	552	233	0	0	6713	104.3%
Local VAMC WH	Drugs	171371	8718	0	2642	3427	0	14787	8.6%
Local VAMC WH	Med	99971	44867	0	1541	2999	0	49407	49.4%
Local VAMC WH	Sub	8117	6187	0	125	406	0	6718	82.8%
NAC Ovhd	Drugs	0	0	0	0	0	1540	1540	0.0%
NAC Ovhd	Med	0	0	0	0	0	1540	1540	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1540	1540	0.0%
All Channels	Drugs	800800	16243	857	8971	11483	1540	39094	4.9%
All Channels	Med	438471	63630	709	2949	11826	1540	80653	18.4%
All Channels	Sub	44040	13854	1491	587	1332	1540	18804	42.7%
All Channels	All	1283311	93727	3057	12506	24641	4620	138552	10.8%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Drugs	98537	20529	15	50131	1055	391	2053	3499	3.6%
CHICAGO IL	Med	18725	3901	16	252401	2308	318	390	3016	16.1%
CHICAGO IL	Sub	7596	1583	12	165348	1380	692	158	2230	29.4%
LOS ANGELES CA	Drugs	40605	8459	6	20658	427	158	846	1431	3.5%
LOS ANGELES CA	Med	8208	1710	7	110639	762	132	171	1065	13.0%
LOS ANGELES CA	Sub	3017	629	5	65673	448	266	63	777	25.7%
SOMERVILLE NJ	Drugs	87493	18228	13	44512	721	308	1823	2852	3.3%
SOMERVILLE NJ	Med	17368	3618	15	234110	1485	259	362	2106	12.1%
SOMERVILLE NJ	Sub	6753	1407	10	146997	870	533	141	1544	22.9%
CHICAGO IL	All	124858	26012	43	467880	4743	1401	2601	8745	7.0%
LOS ANGELES CA	All	51830	10798	18	196970	1637	556	1080	3273	6.3%
SOMERVILLE NJ	All	111614	23253	39	425619	3076	1100	2325	6501	5.8%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	16.5	18.8	15.4	16.5	18.8	15.4
100	200	11.3	11.0	12.0	27.7	29.7	27.3
200	300	11.3	10.6	10.4	39.0	40.3	37.7
300	400	15.9	16.8	16.4	54.9	57.1	54.1
400	500	7.9	6.4	8.1	62.8	63.6	62.2
500	600	4.0	3.6	4.1	66.8	67.1	66.3
600	700	5.4	5.4	6.1	72.2	72.5	72.4
700	800	6.3	5.1	5.8	78.5	77.6	78.2
800	900	3.2	3.0	3.2	81.8	80.7	81.4
900	1000	6.8	7.5	7.3	88.6	88.1	88.7
1000	1500	11.4	11.9	11.3	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Case B-2: Baseline / Modified 08/18/92 at 13:29:04

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	122378	1200	694	2550	0	0	4444	3.6%
Depot Direct	Med	12843	1349	310	268	0	0	1927	15.0%
Depot Direct	Sub	10959	1739	1424	228	0	0	3391	30.9%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	242642	0	0	0	4853	0	4853	2.0%
Local Direct	Med	263521	0	0	0	7906	0	7906	3.0%
Local Direct	Sub	13243	0	0	0	662	0	662	5.0%
Prime Vendor	Drugs	120120	0	0	0	2402	0	2402	2.0%
Prime Vendor	Med	0	0	0	0	0	0	0	0.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	40040	0	0	0	801	0	801	2.0%
Vend Direct	Med	30693	0	0	0	921	0	921	3.0%
Vend Direct	Sub	5285	0	0	0	264	0	264	5.0%
Depot VAMC WH	Drugs	104248	6325	592	3127	0	0	10044	9.6%
Depot VAMC WH	Med	31443	17414	759	943	0	0	19117	60.8%
Depot VAMC WH	Sub	6436	5928	836	193	0	0	6957	108.1%
Local VAMC WH	Drugs	171371	8718	0	1571	3427	0	13716	8.0%
Local VAMC WH	Med	99971	44867	0	916	2999	0	48782	48.8%
Local VAMC WH	Sub	8117	6187	0	74	406	0	6667	82.1%
NAC Ovhd	Drugs	0	0	0	0	0	1540	1540	0.0%
NAC Ovhd	Med	0	0	0	0	0	1540	1540	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1540	1540	0.0%
All Channels	Drugs	800800	16243	1286	7248	11483	1540	37800	4.7%
All Channels	Med	438471	63630	1069	2127	11826	1540	80192	18.3%
All Channels	Sub	44040	13854	2260	496	1332	1540	19482	44.2%
All Channels	All	1283311	93727	4615	9871	24641	4620	137474	10.7%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Drugs	98537	20529	15	50131	1055	592	2053	3700	3.8%
CHICAGO IL	Med	18725	3901	16	252401	2308	475	390	3173	16.9%
CHICAGO IL	Sub	7596	1583	12	165348	1380	1046	158	2584	34.0%
LOS ANGELES CA	Drugs	40605	8459	6	20658	427	233	846	1506	3.7%
LOS ANGELES CA	Med	8208	1710	7	110639	762	199	171	1132	13.8%
LOS ANGELES CA	Sub	3017	629	5	65673	448	405	63	916	30.4%
SOMERVILLE NJ	Drugs	87493	18228	13	44512	721	461	1823	3005	3.4%
SOMERVILLE NJ	Med	17368	3618	15	234110	1485	395	362	2242	12.9%
SOMERVILLE NJ	Sub	6753	1407	10	146997	870	809	141	1820	26.9%
CHICAGO IL	All	124858	26012	43	467880	4743	2113	2601	9457	7.6%
LOS ANGELES CA	All	51830	10798	18	196970	1637	837	1080	3554	6.9%
SOMERVILLE NJ	All	111614	23253	39	425619	3076	1665	2325	7066	6.3%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	16.5	18.8	15.4	16.5	18.8	15.4
100	200	11.3	11.0	12.0	27.7	29.7	27.3
200	300	11.3	10.6	10.4	39.0	40.3	37.7
300	400	15.9	16.8	16.4	54.9	57.1	54.1
400	500	7.9	6.4	8.1	62.8	63.6	62.2
500	600	4.0	3.6	4.1	66.8	67.1	66.3
600	700	5.4	5.4	6.1	72.2	72.5	72.4
700	800	6.3	5.1	5.8	78.5	77.6	78.2
800	900	3.2	3.0	3.2	81.8	80.7	81.4
900	1000	6.8	7.5	7.3	88.6	88.1	88.7
1000	1500	11.4	11.9	11.3	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	752752	6932	3775	9409	0	0	20116	2.7%
Depot Direct	Med	381470	40466	8335	4768	0	0	53569	14.0%
Depot Direct	Sub	37434	6634	4297	468	0	0	11399	30.5%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	4404	673	303	55	220	0	1251	28.4%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	0	0	0	0	0	0	0	0.0%
Prime Vendor	Med	0	0	0	0	0	0	0	0.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	40040	0	0	0	801	0	801	2.0%
Vend Direct	Med	43847	0	0	0	1315	0	1315	3.0%
Vend Direct	Sub	1762	0	0	0	88	0	88	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1680	1680	0.0%
NAC Ovhd	Med	0	0	0	0	0	1680	1680	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1680	1680	0.0%
All Channels	Drugs	800800	6932	3775	9409	961	1680	22757	2.8%
All Channels	Med	438471	40466	8335	4768	1710	1680	56959	13.0%
All Channels	Sub	44040	7307	4600	523	330	1680	14440	32.8%
All Channels	All	1283311	54705	16710	14701	3001	5040	94157	7.3%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
KANSAS CITY MO	Drugs	752769	94096	116	229783	6932	3775	9410	20117	2.7%
KANSAS CITY MO	Med	381439	47680	333	3084936	40466	8335	4768	53569	14.0%
KANSAS CITY MO	Sub	37465	4683	58	489316	6634	4297	468	11399	30.4%
KANSAS CITY MO	All	1171673	146459	506	3804035	54032	16407	14646	85085	7.3%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	1.6	1.2	1.8	1.6	1.2	1.8
100	200	2.3	1.7	2.3	3.9	2.9	4.1
200	300	2.6	2.6	2.7	6.4	5.5	6.8
300	400	3.6	3.3	3.9	10.0	8.8	10.7
400	500	7.6	8.0	7.2	17.6	16.8	17.9
500	600	6.1	6.3	5.7	23.7	23.1	23.6
600	700	10.3	9.3	10.4	34.0	32.4	34.1
700	800	7.7	8.0	7.6	41.7	40.4	41.6
800	900	5.1	4.9	5.3	46.7	45.3	46.9
900	1000	7.0	5.8	7.3	53.7	51.1	54.3
1000	1500	32.7	33.9	32.2	86.4	85.0	86.4
1500	2000	13.6	15.0	13.6	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Sub	616	5255	77	2	12139	89	41	8	136	22.4%
CLEVELAND OH	Sub	805	6867	101	3	15863	116	61	10	187	23.2%
DALLAS TX	Sub	395	3369	49	2	7784	50	27	5	82	20.7%
DENVER CO	Sub	48	409	6	0	946	7	4	1	12	24.2%
JACKSONVILLE FL	Sub	356	3037	44	1	7015	60	25	4	89	25.1%
KANSAS CITY MO	Sub	187	1595	23	1	3685	33	13	2	48	25.8%
LOS ANGELES CA	Sub	391	3335	49	2	7705	61	26	5	92	23.5%
MEMPHIS TN	Sub	299	2551	37	1	5892	51	20	4	75	25.0%
SEATTLE WA	Sub	189	1612	24	1	37[illegible]	31	13	2	46	24.5%
SOMERVILLE NJ	Sub	806	6875	101	3	15883	134	51	10	195	24.2%
OGDEN UT	Sub	104	887	13	0	2049	16	7	1	24	23.4%
ALBUQUERQUE NM	Sub	196	1672	25	1	3[illegible]2	25	15	2	42	21.7%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	616	5255	77	3	12139	89	41	8	138	22.4%
CLEVELAND OH	All	805	6867	101	3	15863	116	61	10	187	23.2%
DALLAS TX	All	395	3369	49	3	7784	50	27	5	82	20.7%
DENVER CO	All	48	409	6	3	946	7	4	1	12	24.2%
JACKSONVILLE FL	All	356	3037	44	3	7015	60	25	4	89	25.1%
KANSAS CITY MO	All	187	1595	23	3	3685	33	13	2	48	25.8%
LOS ANGELES CA	All	391	3335	49	3	7705	61	26	5	92	23.5%
MEMPHIS TN	All	299	2551	37	3	5892	51	20	4	75	25.0%
SEATTLE WA	All	189	1612	24	3	3724	31	13	2	46	24.5%
SOMERVILLE NJ	All	806	6875	101	3	15883	134	51	10	195	24.2%
OGDEN UT	All	104	887	13	3	2049	16	7	1	24	23.4%
ALBUQUERQUE NM	All	196	1672	25	3	3862	25	15	2	42	21.7%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	0.0	0.0	25.2	0.0	0.0	25.2
100	200	0.0	0.0	18.3	0.0	0.0	43.5
200	300	0.0	0.0	21.9	0.0	0.0	65.4
300	400	0.0	0.0	27.7	0.0	0.0	93.1
400	500	0.0	0.0	6.2	0.0	0.0	99.3
500	600	0.0	0.0	0.0	0.0	0.0	99.3
600	700	0.0	0.0	0.7	0.0	0.0	100.0
700	800	0.0	0.0	0.0	0.0	0.0	100.0
800	900	0.0	0.0	0.0	0.0	0.0	100.0
900	1000	0.0	0.0	0.0	0.0	0.0	100.0
1000	1500	0.0	0.0	0.0	0.0	0.0	100.0
1500	2000	0.0	0.0	0.0	0.0	0.0	100.0
2000	2500	0.0	0.0	0.0	0.0	0.0	100.0
2500	3000	0.0	0.0	0.0	0.0	0.0	100.0

Channel / Commmodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	600600	5530	3181	7507	0	0	16218	2.7%
Depot Direct	Med	328853	34885	7585	4111	0	0	46581	14.2%
Depot Direct	Sub	35232	6240	4284	440	0	0	10964	31.1%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	13154	1201	190	164	395	0	1950	14.8%
RDC Direct	Sub	6166	949	427	77	308	0	1761	28.6%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	160160	0	0	0	3203	0	3203	2.0%
Prime Vendor	Med	43847	0	0	0	1315	0	1315	3.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	32032	0	0	0	641	0	641	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	2202	0	0	0	110	0	110	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Med	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1750	1750	0.0%
All Channels	Drugs	800800	5530	3181	7507	4004	1750	21973	2.7%
All Channels	Med	438471	36086	7775	4275	3289	1750	53175	12.1%
All Channels	Sub	44040	7189	4711	517	440	1750	14608	33.2%
All Channels	All	1283311	48805	15667	12300	7733	5250	89755	7.0%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
KANSAS CITY MO	Drugs	600603	75075	92	183334	5530	3181	7508	16219	2.7%
KANSAS CITY MO	Med	328834	41104	287	2659486	34885	7585	4110	46580	14.2%
KANSAS CITY MO	Sub	35245	4406	54	460322	6240	4284	441	10965	31.1%
KANSAS CITY MO	All	964682	120585	433	3303142	46655	15050	12059	73764	7.6%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	1.6	1.2	1.8	1.6	1.2	1.8
100	200	2.3	1.7	2.3	3.9	2.9	4.1
200	300	2.6	2.6	2.7	6.4	5.5	6.8
300	400	3.6	3.3	3.9	10.0	8.8	10.7
400	500	7.6	8.0	7.2	17.6	16.8	17.9
500	600	6.1	6.3	5.7	23.7	23.1	23.6
600	700	10.3	9.3	10.4	34.0	32.4	34.0
700	800	7.7	8.0	7.6	41.7	40.4	41.6
800	900	5.1	4.9	5.3	46.7	45.3	46.9
900	1000	7.0	5.8	7.3	53.7	51.1	54.2
1000	1500	32.7	33.9	32.2	86.4	85.0	86.4
1500	2000	13.6	15.0	13.6	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Med	1860	46533	233	9	37472	160	28	23	211	11.4%
CHICAGO IL	Sub	870	4958	109	3	15225	126	61	11	198	22.7%
CLEVELAND OH	Med	2240	56040	280	11	45128	193	33	28	254	11.3%
CLEVELAND OH	Sub	1133	6456	142	4	19827	164	81	14	259	22.9%
DALLAS TX	Med	1188	29721	149	6	23934	89	17	15	121	10.2%
DALLAS TX	Sub	554	3157	69	2	9695	70	38	7	115	20.7%
DENVER CO	Med	84	2101	10	0	1692	8	0	1	9	10.8%
DENVER CO	Sub	64	365	8	0	1120	10	4	1	15	23.1%
JACKSONVILLE FL	Med	1144	28620	143	5	23047	115	18	14	147	12.9%
JACKSONVILLE FL	Sub	504	2872	63	2	8820	85	35	6	126	25.1%
KANSAS CITY MO	Med	377	9432	47	2	7595	40	7	5	52	13.7%
KANSAS CITY MO	Sub	265	1510	33	1	4637	47	18	3	68	25.8%
LOS ANGELES CA	Med	1392	34825	174	7	28044	130	19	17	166	12.0%
LOS ANGELES CA	Sub	550	3134	69	2	9625	87	40	7	134	24.3%
MEMPHIS TN	Med	890	22266	111	4	17930	89	13	11	113	12.7%
MEMPHIS TN	Sub	421	2399	53	1	7367	71	30	5	106	25.2%
SEATTLE WA	Med	543	13585	68	3	10939	52	7	7	66	12.1%
SEATTLE WA	Sub	265	1510	33	1	4637	43	17	3	63	23.9%
SOMERVILLE NJ	Med	2616	65447	327	12	52702	258	37	33	328	12.5%
SOMERVILLE NJ	Sub	1140	6496	142	4	19950	188	74	14	276	24.2%
OGDEN UT	Med	288	7205	36	1	5802	27	3	4	34	11.7%
OGDEN UT	Sub	144	821	18	0	2520	23	9	2	34	23.5%
ALBUQUERQUE NM	Med	522	13059	65	2	10516	40	8	7	55	10.4%
ALBUQUERQUE NM	Sub	275	1567	34	1	4812	35	20	3	58	21.3%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	2730	51491	341	11	52697	286	89	34	409	15.0%
CLEVELAND OH	All	3373	62496	422	14	64955	357	114	42	513	15.2%
DALLAS TX	All	1742	32878	218	7	33629	159	55	22	236	13.5%
DENVER CO	All	148	2466	19	3	2812	18	4	2	24	16.1%
JACKSONVILLE FL	All	1648	31492	206	7	31867	200	53	21	274	16.6%
KANSAS CITY MO	All	642	10942	80	3	12233	87	25	8	120	18.7%
LOS ANGELES CA	All	1942	37959	243	8	37668	217	59	24	300	15.5%
MEMPHIS TN	All	1311	24665	164	5	25298	160	43	16	219	16.7%
SEATTLE WA	All	808	15095	101	3	15577	95	24	10	129	16.0%
SOMERVILLE NJ	All	3756	71943	469	16	72652	446	111	47	604	16.1%
OGDEN UT	All	432	8026	54	3	8322	50	12	5	67	15.6%
ALBUQUERQUE NM	All	797	14626	100	3	15329	75	28	10	113	14.2%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	0.0	29.7	25.3	0.0	29.7	25.3
100	200	0.0	17.4	18.2	0.0	47.2	43.5
200	300	0.0	20.7	21.9	0.0	67.9	65.4
300	400	0.0	26.1	27.7	0.0	94.0	93.2
400	500	0.0	5.6	6.2	0.0	99.6	99.3
500	600	0.0	0.0	0.0	0.0	99.6	99.3
600	700	0.0	0.4	0.7	0.0	100.0	100.0
700	800	0.0	0.0	0.0	0.0	100.0	100.0
800	900	0.0	0.0	0.0	0.0	100.0	100.0
900	1000	0.0	0.0	0.0	0.0	100.0	100.0
1000	1500	0.0	0.0	0.0	0.0	100.0	100.0
1500	2000	0.0	0.0	0.0	0.0	100.0	100.0
2000	2500	0.0	0.0	0.0	0.0	100.0	100.0
2500	3000	0.0	0.0	0.0	0.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	400400	3687	2373	5005	0	0	11065	2.8%
Depot Direct	Med	263083	27913	6784	3289	0	0	37986	14.4%
Depot Direct	Sub	24222	4291	3281	303	0	0	7875	32.5%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	35078	3211	519	438	1052	0	5221	14.9%
RDC Direct	Sub	10570	1619	834	132	528	0	3114	29.5%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	360360	0	0	0	7207	0	7207	2.0%
Prime Vendor	Med	87694	0	0	0	2631	0	2631	3.0%
Prime Vendor	Sub	6606	0	0	0	330	0	330	5.0%
Vend Direct	Drugs	32032	0	0	0	641	0	641	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	2202	0	0	0	110	0	110	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1820	1820	0.0%
NAC Ovhd	Med	0	0	0	0	0	1820	1820	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1820	1820	0.0%
All Channels	Drugs	800800	3687	2373	5005	8008	1820	20893	2.6%
All Channels	Med	438471	31124	7303	3727	5262	1820	49236	11.2%
All Channels	Sub	44040	5910	4115	435	991	1820	13271	30.1%
All Channels	All	1283311	40721	13791	9167	14261	5460	83399	6.5%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
KANSAS CITY MO	Drugs	400426	50053	62	122230	3687	2373	5005	11065	2.8%
KANSAS CITY MO	Med	263116	32889	229	2127984	27913	6784	3289	37986	14.4%
KANSAS CITY MO	Sub	24229	3029	37	316446	4291	3281	303	7875	32.5%
KANSAS CITY MO	All	687771	85971	328	2566659	35891	12438	8597	56926	8.3%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	1.6	1.2	1.8	1.6	1.2	1.8
100	200	2.3	1.7	2.3	3.9	2.9	4.1
200	300	2.6	2.6	2.7	6.4	5.5	6.8
300	400	3.6	3.3	3.9	10.0	8.8	10.7
400	500	7.6	8.0	7.2	17.6	16.8	17.9
500	600	6.1	6.3	5.7	23.7	23.1	23.6
600	700	10.3	9.3	10.4	34.0	32.4	34.1
700	800	7.7	8.0	7.6	41.7	40.4	41.6
800	900	5.1	4.9	5.3	46.7	45.3	46.9
900	1000	7.0	5.8	7.3	53.7	51.1	54.2
1000	1500	32.7	33.9	32.2	86.4	85.0	86.4
1500	2000	13.6	15.0	13.6	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Med	4968	37250	621	10	58134	428	72	62	562	11.3%
CHICAGO IL	Sub	1486	3404	186	3	22060	215	115	19	349	23.5%
CLEVELAND OH	Med	5978	44822	747	12	69952	515	92	75	682	11.4%
CLEVELAND OH	Sub	1938	4439	242	4	28770	281	158	24	463	23.9%
DALLAS TX	Med	3169	23761	396	6	37082	238	47	40	325	10.2%
DALLAS TX	Sub	949	2174	119	2	14088	120	75	12	207	21.8%
DENVER CO	Med	220	1650	28	0	2574	20	4	3	27	12.2%
DENVER CO	Sub	112	257	14	0	1663	17	10	1	28	25.4%
JACKSONVILLE FL	Med	3056	22914	382	6	35760	309	46	38	393	12.9%
JACKSONVILLE FL	Sub	860	1970	108	2	12767	145	68	11	224	26.0%
KANSAS CITY MO	Med	1009	7565	126	2	11807	107	15	13	135	13.3%
KANSAS CITY MO	Sub	452	1035	57	1	6710	80	36	6	122	26.9%
LOS ANGELES CA	Med	3715	27855	464	8	43471	348	55	46	449	12.1%
LOS ANGELES CA	Sub	941	2156	118	2	13969	148	74	12	234	24.8%
MEMPHIS TN	Med	2377	17822	297	5	27815	240	35	30	305	12.8%
MEMPHIS TN	Sub	720	1649	90	2	10688	122	59	9	190	26.4%
SEATTLE WA	Med	1451	10879	181	3	16979	140	21	18	179	12.3%
SEATTLE WA	Sub	454	1040	57	1	6740	73	34	6	113	24.8%
SOMERVILLE NJ	Med	6992	52425	874	14	81818	690	98	87	875	12.5%
SOMERVILLE NJ	Sub	1946	4458	243	4	28889	321	142	24	487	25.0%
OGDEN UT	Med	767	5751	96	2	8975	72	11	10	93	12.1%
OGDEN UT	Sub	248	568	31	1	3682	38	21	3	62	25.0%
ALBUQUERQUE NM	Med	1390	10422	174	3	16265	104	23	17	144	10.4%
ALBUQUERQUE NM	Sub	471	1079	59	1	6992	59	42	6	107	22.7%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	6454	40654	807	13	80193	643	187	81	911	14.1%
CLEVELAND OH	All	7916	49262	990	16	98722	796	250	99	1145	14.5%
DALLAS TX	All	4118	25935	515	8	51170	358	122	51	531	12.9%
DENVER CO	All	332	1906	42	3	4237	37	14	4	55	16.6%
JACKSONVILLE FL	All	3916	24884	489	8	48527	454	114	49	617	15.8%
KANSAS CITY MO	All	1461	8601	183	3	18517	187	51	18	256	17.5%
LOS ANGELES CA	All	4656	30010	582	10	57441	496	129	58	683	14.7%
MEMPHIS TN	All	3097	19472	387	6	38503	362	94	39	495	16.0%
SEATTLE WA	All	1905	11919	238	4	23719	213	55	24	292	15.3%
SOMERVILLE NJ	All	8938	56883	1117	18	110706	1011	240	112	1363	15.2%
OGDEN UT	All	1015	6319	127	3	12657	110	32	13	155	15.2%
ALBUQUERQUE NM	All	1861	11501	233	4	23257	163	65	23	251	13.5%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	0.0	29.7	25.2	0.0	29.7	25.2
100	200	0.0	17.4	18.2	0.0	47.2	43.5
200	300	0.0	20.7	21.9	0.0	67.9	65.4
300	400	0.0	26.1	27.7	0.0	94.0	93.2
400	500	0.0	5.6	6.2	0.0	99.6	99.3
500	600	0.0	0.0	0.0	0.0	99.6	99.3
600	700	0.0	0.4	0.7	0.0	100.0	100.0
700	800	0.0	0.0	0.0	0.0	100.0	100.0
800	900	0.0	0.0	0.0	0.0	100.0	100.0
900	1000	0.0	0.0	0.0	0.0	100.0	100.0
1000	1500	0.0	0.0	0.0	0.0	100.0	100.0
1500	2000	0.0	0.0	0.0	0.0	100.0	100.0
2000	2500	0.0	0.0	0.0	0.0	100.0	100.0
2500	3000	0.0	0.0	0.0	0.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	720720	8119	2329	21021	0	0	31469	4.4%
Depot Direct	Med	385854	56528	6581	11254	0	0	74363	19.3%
Depot Direct	Sub	40957	10616	3114	1195	0	0	14925	36.4%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	0	0	0	0	0	0	0	0.0%
Prime Vendor	Med	0	0	0	0	0	0	0	0.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	72072	0	0	0	1441	0	1441	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	2642	0	0	0	132	0	132	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1680	1680	0.0%
NAC Ovhd	Med	0	0	0	0	0	1680	1680	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1680	1680	0.0%
All Channels	Drugs	800800	8119	2329	21021	1602	1680	34751	4.3%
All Channels	Med	438471	56528	6581	11254	1578	1680	77622	17.7%
All Channels	Sub	44040	10616	3114	1195	154	1680	16759	38.1%
All Channels	All	1283311	75263	12024	33470	3334	5040	129131	10.1%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
ATLANTA GA	Drugs	89473	26096	14	63727	807	291	2610	3708	4.1%
ATLANTA GA	Med	18624	5432	16	351456	1880	303	543	2726	14.6%
ATLANTA GA	Sub	3328	971	5	101420	562	251	97	910	27.3%
CHICAGO IL	Drugs	186966	54532	29	133167	1580	608	5453	7641	4.1%
CHICAGO IL	Med	130867	38170	114	2469608	11268	2409	3817	17494	13.4%
CHICAGO IL	Sub	11379	3319	18	346773	1648	885	332	2865	25.2%
DALLAS TX	Drugs	139459	40676	21	99330	1121	506	4068	5695	4.1%
DALLAS TX	Med	153699	44829	134	2900473	11523	2758	4483	18764	12.2%
DALLAS TX	Sub	10168	2966	16	309868	1289	881	297	2467	24.3%
LOS ANGELES CA	Drugs	87935	25648	14	62632	767	281	2565	3613	4.1%
LOS ANGELES CA	Med	50140	14624	44	946198	4685	681	1462	6828	13.6%
LOS ANGELES CA	Sub	4509	1315	7	137411	707	328	132	1167	25.9%
SEATTLE WA	Drugs	36853	10749	6	26249	325	119	1075	1519	4.1%
SEATTLE WA	Med	19287	5625	17	363967	1850	253	563	2666	13.8%
SEATTLE WA	Sub	2355	687	4	71768	378	173	69	620	26.3%
SOMERVILLE NJ	Drugs	180034	52510	28	128229	1607	524	5251	7382	4.1%
SOMERVILLE NJ	Med	13234	3860	12	249740	1305	177	386	1868	14.1%
SOMERVILLE NJ	Sub	9209	2686	14	280642	1520	596	269	2385	25.9%
ATLANTA GA	All	111425	32499	35	516603	3249	845	3250	7344	6.6%
CHICAGO IL	All	329212	96020	160	2949547	14496	3902	9602	28000	8.5%
DALLAS TX	All	303326	88470	171	3309670	13933	4145	8847	26925	8.9%
LOS ANGELES CA	All	142584	41587	64	1146241	6159	1290	4159	11608	8.1%
SEATTLE WA	All	58495	17061	26	461984	2553	545	1706	4804	8.2%
SOMERVILLE NJ	All	202477	59056	53	658612	4432	1297	5906	11635	5.7%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	20.6	8.0	19.6	20.6	8.0	19.6
100	200	16.9	4.4	15.4	37.5	12.4	35.0
200	300	18.8	10.6	16.4	56.4	23.0	51.4
300	400	19.3	10.1	15.5	75.7	33.1	66.9
400	500	11.8	8.6	10.8	87.5	41.7	77.7
500	600	4.0	6.0	7.3	91.5	47.7	85.0
600	700	3.2	8.2	7.1	94.7	55.8	92.1
700	800	3.7	15.4	5.5	98.5	71.2	97.6
800	900	0.5	15.6	1.2	99.0	86.8	98.8
900	1000	1.0	13.2	1.2	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	576576	6511	1931	16817	0	0	25258	4.4%
Depot Direct	Med	350777	51388	6213	10231	0	0	67832	19.3%
Depot Direct	Sub	40957	10628	3244	1195	0	0	15066	36.8%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	160160	0	0	0	3203	0	3203	2.0%
Prime Vendor	Med	43847	0	0	0	1315	0	1315	3.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	56056	0	0	0	1121	0	1121	2.0%
Vend Direct	Med	30693	0	0	0	921	0	921	3.0%
Vend Direct	Sub	2642	0	0	0	132	0	132	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Med	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1750	1750	0.0%
All Channels	Drugs	800800	6511	1931	16817	4484	1750	31493	3.9%
All Channels	Med	438471	51388	6213	10231	2631	1750	72213	16.5%
All Channels	Sub	44040	10628	3244	1195	154	1750	16970	38.5%
All Channels	All	1283311	68527	11388	28242	7269	5250	120676	9.4%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
ATLANTA GA	Drugs	78126	22787	12	55645	704	265	2279	3248	4.2%
ATLANTA GA	Med	16930	4938	15	319488	1709	284	494	2487	14.7%
ATLANTA GA	Sub	3328	971	5	101420	562	264	97	923	27.7%
CHICAGO IL	Drugs	149575	43626	23	106535	1265	508	4363	6136	4.1%
CHICAGO IL	Med	118963	34698	104	2244966	10243	2273	3470	15986	13.4%
CHICAGO IL	Sub	11650	3398	18	355031	1687	950	340	2977	25.6%
DALLAS TX	Drugs	105025	30632	16	74804	843	388	3063	4294	4.1%
DALLAS TX	Med	139721	40752	122	2636692	10475	2609	4075	17159	12.3%
DALLAS TX	Sub	9897	2887	15	301609	1255	883	289	2427	24.5%
LOS ANGELES CA	Drugs	70349	20518	11	50106	614	233	2052	2899	4.1%
LOS ANGELES CA	Med	45581	13294	40	860165	4259	641	1329	6229	13.7%
LOS ANGELES CA	Sub	4509	1315	7	137411	707	342	132	1181	26.2%
SEATTLE WA	Drugs	29485	8600	5	21001	260	98	860	1218	4.1%
SEATTLE WA	Med	17534	5114	15	330886	1682	238	511	2431	13.9%
SEATTLE WA	Sub	2355	687	4	71768	378	179	69	626	26.6%
SOMERVILLE NJ	Drugs	144026	42008	22	102583	1286	439	4201	5926	4.1%
SOMERVILLE NJ	Med	12030	3509	10	227020	1187	168	351	1706	14.2%
SOMERVILLE NJ	Sub	9209	2686	14	280642	1520	626	269	2415	26.2%
ATLANTA GA	All	98384	28695	32	476553	2975	813	2870	6658	6.8%
CHICAGO IL	All	280188	81721	145	2706532	13195	3731	8172	25098	9.0%
DALLAS TX	All	254643	74271	153	3013106	12573	3880	7427	23880	9.4%
LOS ANGELES CA	All	120439	35128	57	1047682	5580	1216	3513	10309	8.6%
SEATTLE WA	All	49374	14401	23	423655	2320	515	1440	4275	8.7%
SOMERVILLE NJ	All	165265	48202	47	610245	3993	1233	4820	10046	6.1%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	20.6	8.0	19.6	20.6	8.0	19.6
100	200	16.9	4.4	15.4	37.5	12.4	35.0
200	300	20.0	10.6	16.4	57.5	23.0	51.4
300	400	19.3	10.1	15.5	76.8	33.1	66.9
400	500	10.7	8.6	10.8	87.5	41.7	77.7
500	600	5.2	6.0	8.0	92.7	47.7	85.7
600	700	2.1	8.2	7.1	94.7	55.8	92.7
700	800	3.7	15.4	5.5	98.5	71.2	98.3
800	900	0.5	15.6	0.5	99.0	86.8	98.8
900	1000	1.0	13.2	1.2	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	MAC Cost	Tot Cost	Pct
Depot Direct	Drugs	400400	4526	1459	11678	0	0	17663	4.4%
Depot Direct	Med	298160	43956	5596	8696	0	0	58248	19.5%
Depot Direct	Sub	34351	8934	2951	1002	0	0	12887	37.5%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	360360	0	0	0	7207	0	7207	2.0%
Prime Vendor	Med	87694	0	0	0	2631	0	2631	3.0%
Prime Vendor	Sub	6606	0	0	0	330	0	330	5.0%
Vend Direct	Drugs	32032	0	0	0	641	0	641	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	2642	0	0	0	132	0	132	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
MAC Ovhd	Drugs	0	0	0	0	0	1820	1820	0.0%
MAC Ovhd	Med	0	0	0	0	0	1820	1820	0.0%
MAC Ovhd	Sub	0	0	0	0	0	1820	1820	0.0%
All Channels	Drugs	800800	4526	1459	11678	8008	1820	27491	3.4%
All Channels	Med	438471	43956	5596	8696	4209	1820	64278	14.7%
All Channels	Sub	44040	8934	2951	1002	484	1820	15192	34.5%
All Channels	All	1283311	57416	10006	21377	12702	5460	106960	8.3%

Depot Locations and Cost

Location	Comm	Thruput	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
ATLANTA GA	Drugs	56977	16618	9	40582	513	212	1662	2387	4.2%
ATLANTA GA	Med	14391	4197	13	271574	1453	262	420	2135	14.8%
ATLANTA GA	Sub	2792	814	4	85086	471	240	81	792	28.4%
CHICAGO IL	Drugs	101161	29505	16	72052	855	375	2951	4181	4.1%
CHICAGO IL	Med	111775	32601	97	2109320	9624	2218	3260	15102	13.5%
CHICAGO IL	Sub	9457	2758	15	288200	1369	831	276	2476	26.2%
DALLAS TX	Drugs	72932	21272	11	51946	586	294	2127	3007	4.1%
DALLAS TX	Med	108112	31533	94	2040195	8105	2148	3153	13406	12.4%
DALLAS TX	Sub	8308	2423	13	253185	1054	803	242	2099	25.3%
LOS ANGELES CA	Drugs	48854	14249	8	34796	427	175	1425	2027	4.1%
LOS ANGELES CA	Med	38745	11301	34	731162	3620	593	1130	5343	13.8%
LOS ANGELES CA	Sub	3787	1105	6	115408	594	313	110	1017	26.9%
SEATTLE WA	Drugs	20474	5972	3	14583	181	74	597	852	4.2%
SEATTLE WA	Med	14905	4347	13	281274	1429	220	435	2084	14.0%
SEATTLE WA	Sub	1978	577	3	60279	317	164	58	539	27.2%
SOMERVILLE NJ	Drugs	100028	29175	15	71245	893	329	2917	4139	4.1%
SOMERVILLE NJ	Med	10226	2983	9	192976	1009	155	298	1462	14.3%
SOMERVILLE NJ	Sub	8045	2346	12	245170	1328	600	235	2163	26.9%
ATLANTA GA	All	74160	21630	26	397242	2437	714	2163	5314	7.2%
CHICAGO IL	All	222393	64865	128	2469572	11848	3424	6486	21758	9.8%
DALLAS TX	All	189352	55228	118	2345325	9745	3245	5523	18513	9.8%
LOS ANGELES CA	All	91386	26654	47	881366	4641	1081	2665	8387	9.2%
SEATTLE WA	All	37357	10896	19	356136	1927	458	1090	3475	9.3%
SOMERVILLE NJ	All	118299	34504	37	509391	3230	1084	3450	7764	6.6%

Depot Demand Profile (miles from depot)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	20.6	11.5	19.6	20.6	11.5	19.6
100	200	16.9	4.4	15.4	37.5	16.0	35.0
200	300	20.0	10.6	17.3	57.5	26.6	52.3
300	400	19.3	10.1	15.5	76.8	36.7	67.8
400	500	11.4	8.6	10.8	88.2	45.2	78.6
500	600	5.2	6.0	7.7	93.3	51.2	86.3
600	700	1.4	8.2	6.4	94.8	59.4	92.7
700	800	3.7	15.4	5.5	98.5	74.8	98.3
800	900	0.5	15.6	0.5	99.0	90.4	98.8
900	1000	1.0	9.6	1.2	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	0	0	0	0	0	0	0	0.0%
Depot Direct	Med	0	0	0	0	0	0	0	0.0%
Depot Direct	Sub	0	0	0	0	0	0	0	0.0%
RDC Direct	Drugs	320320	2777	1112	4004	6406	0	14299	4.5%
RDC Direct	Med	263083	24054	3917	3289	7892	0	39152	14.9%
RDC Direct	Sub	40076	6140	3244	501	2004	0	11889	29.7%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	400400	0	0	0	8008	0	8008	2.0%
Prime Vendor	Med	122772	0	0	0	3683	0	3683	3.0%
Prime Vendor	Sub	0	0	0	0	0	0	0	0.0%
Vend Direct	Drugs	72072	0	0	0	1441	0	1441	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	3523	0	0	0	176	0	176	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Med	0	0	0	0	0	1750	1750	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1750	1750	0.0%
All Channels	Drugs	800800	2777	1112	4004	16016	1750	25659	3.2%
All Channels	Med	438471	24054	3917	3289	13154	1750	46164	10.5%
All Channels	Sub	44040	6140	3244	501	2202	1750	13837	31.4%
All Channels	All	1283311	32971	8273	7793	31372	5250	85660	6.7%

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Drugs	43740	0	5467	7	13352	370	152	547	1069	2.4%
CHICAGO IL	Med	37240	0	4655	32	301183	3206	555	465	4226	11.3%
CHICAGO IL	Sub	5628	0	703	9	73505	815	456	70	1341	23.8%
CLEVELAND OH	Drugs	52261	0	6533	8	15953	442	188	653	1283	2.5%
CLEVELAND OH	Med	44826	0	5603	39	362536	3859	691	560	5110	11.4%
CLEVELAND OH	Sub	7344	0	918	11	95917	1064	612	92	1768	24.1%
DALLAS TX	Drugs	29146	0	3643	4	8897	234	104	364	702	2.4%
DALLAS TX	Med	23770	0	2971	21	192243	1782	360	297	2439	10.3%
DALLAS TX	Sub	3598	0	450	6	46992	456	293	45	794	22.1%
DENVER CO	Drugs	7399	0	925	1	2259	65	23	92	180	2.4%
DENVER CO	Med	1664	0	208	1	13458	156	27	21	204	12.2%
DENVER CO	Sub	428	0	53	1	5590	67	37	5	109	25.5%
JACKSONVILLE FL	Drugs	27044	0	3380	4	8255	244	98	338	680	2.5%
JACKSONVILLE FL	Med	22904	0	2863	20	185239	2312	355	286	2953	12.9%
JACKSONVILLE FL	Sub	3256	0	407	5	42525	549	273	41	863	26.5%
KANSAS CITY MO	Drugs	11666	0	1458	2	3561	107	40	146	293	2.5%
KANSAS CITY MO	Med	7558	0	945	7	61126	802	113	94	1009	13.4%
KANSAS CITY MO	Sub	1711	0	214	3	22347	303	138	21	462	27.0%
LOS ANGELES CA	Drugs	30756	0	3844	5	9388	269	105	384	758	2.5%
LOS ANGELES CA	Med	27858	0	3482	24	225305	2603	408	348	3359	12.1%
LOS ANGELES CA	Sub	3566	0	446	5	46574	559	286	45	890	24.9%
MEMPHIS TN	Drugs	22748	0	2843	3	6944	205	82	284	571	2.5%
MEMPHIS TN	Med	17822	0	2228	16	144138	1799	277	223	2299	12.9%
MEMPHIS TN	Sub	2728	0	341	4	35629	460	229	34	723	26.5%
SEATTLE WA	Drugs	12350	0	1544	2	3770	109	41	154	304	2.5%
SEATTLE WA	Med	10882	0	1360	9	88010	1044	152	136	1332	12.2%
SEATTLE WA	Sub	1721	0	215	3	22477	276	132	22	430	25.0%
SOMERVILLE NJ	Drugs	64874	0	8109	10	19803	580	211	811	1602	2.5%
SOMERVILLE NJ	Med	52404	0	6550	46	423824	5170	726	655	6551	12.5%
SOMERVILLE NJ	Sub	7368	0	921	11	96231	1216	552	92	1860	25.2%
OGDEN UT	Drugs	7153	0	894	1	2183	62	26	89	177	2.5%
OGDEN UT	Med	5760	0	720	5	46585	539	81	72	692	12.0%
OGDEN UT	Sub	942	0	118	1	12303	148	77	12	237	25.1%
ALBUQUERQUE NM	Drugs	11157	0	1395	2	3406	90	42	139	271	2.4%
ALBUQUERQUE NM	Med	10428	0	1303	9	84338	782	172	130	1084	10.4%
ALBUQUERQUE NM	Sub	1786	0	223	3	23326	227	159	22	408	22.9%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	86608	0	10826	48	388040	4391	1163	1083	6637	7.7%
CLEVELAND OH	All	104431	0	13054	58	474406	5365	1491	1305	8161	7.8%
DALLAS TX	All	56514	0	7064	31	248132	2472	757	706	3935	7.0%
DENVER CO	All	9491	0	1186	3	21306	288	87	119	494	5.2%
JACKSONVILLE FL	All	53204	0	6651	29	236020	3105	726	665	4496	8.5%
KANSAS CITY MO	All	20935	0	2617	11	87034	1212	291	262	1765	8.4%
LOS ANGELES CA	All	62180	0	7772	35	281268	3431	799	777	5007	8.1%
MEMPHIS TN	All	43298	0	5412	23	186711	2464	588	541	3593	8.3%
SEATTLE WA	All	24953	0	3119	14	114257	1429	325	312	2066	8.3%
SOMERVILLE NJ	All	124646	0	15581	67	539857	6966	1489	1558	10013	8.0%
OGDEN UT	All	13855	0	1732	8	61071	749	184	173	1106	8.0%
ALBUQUERQUE NM	All	23371	0	2921	14	111070	1099	373	292	1764	7.5%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	27.5	29.7	25.2	27.5	29.7	25.2
100	200	20.1	17.4	18.3	47.6	47.2	43.5
200	300	22.7	20.7	21.9	70.3	67.9	65.4
300	400	23.3	26.1	27.7	93.6	94.0	93.2
400	500	5.9	5.6	6.2	99.5	99.6	99.3
500	600	0.0	0.0	0.0	99.5	99.6	99.3
600	700	0.5	0.4	0.7	100.0	100.0	100.0
700	800	0.0	0.0	0.0	100.0	100.0	100.0
800	900	0.0	0.0	0.0	100.0	100.0	100.0
900	1000	0.0	0.0	0.0	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	0	0	0	0	0	0	0	0.0%
Depot Direct	Med	0	0	0	0	0	0	0	0.0%
Depot Direct	Sub	0	0	0	0	0	0	0	0.0%
RDC Direct	Drugs	128128	1110	499	1602	2563	0	5773	4.5%
RDC Direct	Med	166619	15237	2810	2083	4999	0	25128	15.1%
RDC Direct	Sub	31268	4790	2861	391	1563	0	9605	30.7%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	600600	0	0	0	12012	0	12012	2.0%
Prime Vendor	Med	219235	0	0	0	6577	0	6577	3.0%
Prime Vendor	Sub	8808	0	0	0	440	0	440	5.0%
Vend Direct	Drugs	64064	0	0	0	1281	0	1281	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	3523	0	0	0	176	0	176	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	1890	1890	0.0%
NAC Ovhd	Med	0	0	0	0	0	1890	1890	0.0%
NAC Ovhd	Sub	0	0	0	0	0	1890	1890	0.0%
All Channels	Drugs	800800	1110	499	1602	16016	1890	21117	2.6%
All Channels	Med	438471	15237	2810	2083	13154	1890	35174	8.0%
All Channels	Sub	44040	4790	2861	391	2202	1890	12134	27.6%
All Channels	All	1283311	21137	6170	4075	31372	5670	68424	5.3%

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Drugs	17500	0	2188	3	5342	148	69	219	436	2.5%
CHICAGO IL	Med	23588	0	2948	21	190771	2031	400	295	2726	11.6%
CHICAGO IL	Sub	4390	0	549	7	57336	636	402	55	1093	24.9%
CLEVELAND OH	Drugs	20909	0	2614	3	6382	176	83	261	520	2.5%
CLEVELAND OH	Med	28391	0	3549	25	229616	2445	496	355	3296	11.6%
CLEVELAND OH	Sub	5728	0	716	9	74811	830	538	72	1440	25.1%
DALLAS TX	Drugs	11661	0	1458	2	3560	93	43	146	282	2.4%
DALLAS TX	Med	15054	0	1882	13	121751	1129	259	188	1576	10.5%
DALLAS TX	Sub	2804	0	351	4	36622	355	260	35	650	23.2%
DENVER CO	Drugs	2960	0	370	0	904	26	11	37	74	2.5%
DENVER CO	Med	1052	0	132	1	8508	99	19	13	131	12.5%
DENVER CO	Sub	332	0	42	1	4336	52	33	4	89	26.9%
JACKSONVILLE FL	Drugs	10820	0	1353	2	3303	98	46	135	279	2.6%
JACKSONVILLE FL	Med	14508	0	1814	13	117335	1464	254	181	1899	13.1%
JACKSONVILLE FL	Sub	2540	0	317	4	33174	429	241	32	702	27.6%
KANSAS CITY MO	Drugs	4668	0	583	1	1425	43	18	58	119	2.6%
KANSAS CITY MO	Med	4788	0	599	4	38724	508	81	60	649	13.6%
KANSAS CITY MO	Sub	1337	0	167	2	17462	237	123	17	377	28.2%
LOS ANGELES CA	Drugs	12305	0	1538	2	3756	107	49	154	310	2.5%
LOS ANGELES CA	Med	17644	0	2206	15	142698	1649	293	221	2163	12.3%
LOS ANGELES CA	Sub	2778	0	347	4	36282	436	251	35	722	26.0%
MEMPHIS TN	Drugs	9102	0	1138	1	2778	82	36	114	232	2.5%
MEMPHIS TN	Med	11288	0	1411	10	91293	1139	196	141	1476	13.1%
MEMPHIS TN	Sub	2127	0	266	3	27780	359	201	27	587	27.6%
SEATTLE WA	Drugs	4942	0	618	1	1509	44	18	62	124	2.5%
SEATTLE WA	Med	6892	0	862	6	55740	661	110	86	857	12.4%
SEATTLE WA	Sub	1341	0	168	2	17514	215	117	17	349	26.0%
SOMERVILLE NJ	Drugs	25957	0	3245	4	7923	232	93	324	649	2.5%
SOMERVILLE NJ	Med	33194	0	4149	29	268461	3275	521	415	4211	12.7%
SOMERVILLE NJ	Sub	5746	0	718	9	75046	949	486	72	1507	26.2%
OGDEN UT	Drugs	2862	0	358	0	874	25	13	36	74	2.6%
OGDEN UT	Med	3647	0	456	3	29496	342	58	46	446	12.2%
OGDEN UT	Sub	733	0	92	1	9573	115	69	9	193	26.4%
ALBUQUERQUE NM	Drugs	4463	0	558	1	1362	36	20	56	112	2.5%
ALBUQUERQUE NM	Med	6604	0	826	6	53411	495	123	83	701	10.6%
ALBUQUERQUE NM	Sub	1393	0	174	2	18193	177	140	17	334	24.0%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	45478	0	5685	30	253449	2815	871	568	4254	9.4%
CLEVELAND OH	All	55028	0	6878	37	310809	3451	1117	688	5256	9.6%
DALLAS TX	All	29519	0	3690	19	161933	1577	562	369	2508	8.5%
DENVER CO	All	4344	0	543	3	13748	177	63	54	294	6.8%
JACKSONVILLE FL	All	27868	0	3483	18	153812	1991	541	348	2880	10.3%
KANSAS CITY MO	All	10793	0	1349	7	57611	788	222	135	1145	10.6%
LOS ANGELES CA	All	32727	0	4091	22	182737	2192	593	409	3194	9.8%
MEMPHIS TN	All	22517	0	2815	15	121851	1580	433	281	2294	10.2%
SEATTLE WA	All	13175	0	1647	9	74763	920	245	165	1330	10.1%
SOMERVILLE NJ	All	64897	0	8112	42	351430	4456	1100	811	6367	9.8%
OGDEN UT	All	7242	0	905	5	39943	482	140	91	713	9.8%
ALBUQUERQUE NM	All	12460	0	1558	9	72966	708	283	156	1147	9.2%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	27.5	29.7	25.2	27.5	29.7	25.2
100	200	20.1	17.4	18.3	47.6	47.2	43.5
200	300	22.7	20.7	21.9	70.3	67.9	65.4
300	400	23.3	26.1	27.7	93.6	94.0	93.2
400	500	5.9	5.6	6.2	99.5	99.6	99.3
500	600	0.0	0.0	0.0	99.5	99.6	99.3
600	700	0.5	0.4	0.7	100.0	100.0	100.0
700	800	0.0	0.0	0.0	100.0	100.0	100.0
800	900	0.0	0.0	0.0	100.0	100.0	100.0
900	1000	0.0	0.0	0.0	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	0	0	0	0	0	0	0	0.0%
Depot Direct	Med	0	0	0	0	0	0	0	0.0%
Depot Direct	Sub	0	0	0	0	0	0	0	0.0%
RDC Direct	Drugs	80080	693	374	1001	1602	0	3670	4.6%
RDC Direct	Med	57001	5207	1107	713	1710	0	8737	15.3%
RDC Direct	Sub	22901	3514	2418	286	1145	0	7363	32.2%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	680680	0	0	0	13614	0	13614	2.0%
Prime Vendor	Med	328853	0	0	0	9866	0	9866	3.0%
Prime Vendor	Sub	17616	0	0	0	881	0	881	5.0%
Vend Direct	Drugs	32032	0	0	0	641	0	641	2.0%
Vend Direct	Med	39462	0	0	0	1184	0	1184	3.0%
Vend Direct	Sub	3083	0	0	0	154	0	154	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	2100	2100	0.0%
NAC Ovhd	Med	0	0	0	0	0	2100	2100	0.0%
NAC Ovhd	Sub	0	0	0	0	0	2100	2100	0.0%
All Channels	Drugs	800800	693	374	1001	16016	2100	20184	2.5%
All Channels	Med	438471	5207	1107	713	13154	2100	22281	5.1%
All Channels	Sub	44040	3514	2418	286	2202	2100	10520	23.9%
All Channels	All	1283311	9414	3899	2000	31372	6300	52985	4.1%

RDC Locations and Cost

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	Drugs	10391	0	1299	2	3172	88	49	130	267	2.6%
CHICAGO IL	Med	8064	0	1008	7	65219	694	157	101	952	11.8%
CHICAGO IL	Sub	3214	0	402	5	41977	466	343	40	849	26.4%
CLEVELAND OH	Drugs	12156	0	1520	2	3711	102	59	152	313	2.6%
CLEVELAND OH	Med	9706	0	1213	8	78498	836	197	121	1154	11.9%
CLEVELAND OH	Sub	4194	0	524	6	54776	608	456	52	1116	26.6%
DALLAS TX	Drugs	7287	0	911	1	2224	58	35	91	184	2.5%
DALLAS TX	Med	5147	0	643	4	41627	385	102	64	551	10.7%
DALLAS TX	Sub	2054	0	257	3	26827	260	221	26	507	24.7%
DENVER CO	Drugs	1851	0	231	0	565	16	8	23	47	2.5%
DENVER CO	Med	360	0	45	0	2912	34	8	5	47	12.9%
DENVER CO	Sub	508	0	63	1	6635	80	50	6	136	26.8%
JACKSONVILLE FL	Drugs	6760	0	845	1	2063	61	33	84	178	2.6%
JACKSONVILLE FL	Med	4960	0	620	4	40115	500	100	62	662	13.3%
JACKSONVILLE FL	Sub	1860	0	233	3	24293	314	203	23	540	29.0%
KANSAS CITY MO	Drugs	3459	0	432	1	1056	32	14	43	89	2.6%
KANSAS CITY MO	Med	1636	0	204	1	13231	173	32	20	225	13.8%
KANSAS CITY MO	Sub	977	0	122	2	12760	173	104	12	289	29.6%
LOS ANGELES CA	Drugs	7689	0	961	1	2347	67	35	96	198	2.6%
LOS ANGELES CA	Med	6033	0	754	5	48793	564	113	75	752	12.5%
LOS ANGELES CA	Sub	2036	0	254	3	26591	319	213	25	557	27.4%
MEMPHIS TN	Drugs	5687	0	711	1	1736	52	29	71	152	2.7%
MEMPHIS TN	Med	3859	0	482	3	31210	390	77	48	515	13.4%
MEMPHIS TN	Sub	1557	0	195	2	20335	262	171	19	452	29.1%
SEATTLE WA	Drugs	3088	0	386	0	943	27	14	39	80	2.6%
SEATTLE WA	Med	2356	0	294	2	19054	226	44	29	299	12.7%
SEATTLE WA	Sub	981	0	123	2	12812	157	100	12	269	27.4%
SOMERVILLE NJ	Drugs	17126	0	2141	3	5228	152	76	214	442	2.6%
SOMERVILLE NJ	Med	11348	0	1418	10	91778	1119	205	142	1466	12.9%
SOMERVILLE NJ	Sub	4206	0	526	6	54933	694	413	53	1160	27.6%
OGDEN UT	Drugs	1789	0	224	0	546	16	8	22	46	2.6%
OGDEN UT	Med	1247	0	156	1	10085	117	23	16	156	12.5%
OGDEN UT	Sub	537	0	67	1	7014	85	58	7	150	27.9%
ALBUQUERQUE NM	Drugs	2789	0	349	0	851	22	14	35	71	2.5%
ALBUQUERQUE NM	Med	2258	0	282	2	18262	169	49	28	246	10.9%
ALBUQUERQUE NM	Sub	757	0	95	1	9887	96	86	9	191	25.3%

RDC Locations and Cost (cont'd)

Location	Comm	Thruput	BB Flow	Inventory	No Pers	Sq Feet	Whse Cost	Tran Cost	Inv Cost	Tot Cost	Pct
CHICAGO IL	All	21669	0	2709	14	110367	1248	549	271	2068	9.5%
CLEVELAND OH	All	26056	0	3257	17	136985	1546	712	326	2584	9.9%
DALLAS TX	All	14488	0	1811	9	70678	703	358	181	1242	8.6%
DENVER CO	All	2719	0	340	3	10111	130	66	34	230	8.5%
JACKSONVILLE FL	All	13580	0	1698	8	66471	875	336	170	1381	10.2%
KANSAS CITY MO	All	6072	0	759	3	27047	378	150	76	604	9.9%
LOS ANGELES CA	All	15758	0	1970	10	77731	950	361	197	1508	9.6%
MEMPHIS TN	All	11103	0	1388	7	53281	704	277	139	1120	10.1%
SEATTLE WA	All	6425	0	803	4	32810	410	158	80	648	10.1%
SOMERVILLE NJ	All	32680	0	4085	19	151939	1965	694	408	3068	9.4%
OGDEN UT	All	3573	0	447	3	17645	218	89	45	352	9.8%
ALBUQUERQUE NM	All	5804	0	725	4	29000	287	149	73	509	8.8%

RDC Demand Profile (miles from RDC)

From	To	Pct Drugs	Pct Med	Pct Sub	Cum Pct Drugs	Cum Pct Med	Cum Pct Sub
0	100	27.5	29.7	26.4	27.5	29.7	26.4
100	200	21.2	17.4	18.2	48.7	47.2	44.6
200	300	23.3	20.7	22.0	72.1	67.9	66.6
300	400	21.5	26.1	26.6	93.6	94.0	93.2
400	500	5.9	5.6	6.2	99.5	99.6	99.3
500	600	0.0	0.0	0.0	99.5	99.6	99.3
600	700	0.5	0.4	0.7	100.0	100.0	100.0
700	800	0.0	0.0	0.0	100.0	100.0	100.0
800	900	0.0	0.0	0.0	100.0	100.0	100.0
900	1000	0.0	0.0	0.0	100.0	100.0	100.0
1000	1500	0.0	0.0	0.0	100.0	100.0	100.0
1500	2000	0.0	0.0	0.0	100.0	100.0	100.0
2000	2500	0.0	0.0	0.0	100.0	100.0	100.0
2500	3000	0.0	0.0	0.0	100.0	100.0	100.0

Channel / Commodity Group Flow and Cost

Channel	Comm	Thruput	Whse Cost	Tran Cost	Inv Cost	Markup	NAC Cost	Tot Cost	Pct
Depot Direct	Drugs	0	0	0	0	0	0	0	0.0%
Depot Direct	Med	0	0	0	0	0	0	0	0.0%
Depot Direct	Sub	0	0	0	0	0	0	0	0.0%
RDC Direct	Drugs	0	0	0	0	0	0	0	0.0%
RDC Direct	Med	0	0	0	0	0	0	0	0.0%
RDC Direct	Sub	0	0	0	0	0	0	0	0.0%
Local Direct	Drugs	8008	0	0	0	160	0	160	2.0%
Local Direct	Med	13154	0	0	0	395	0	395	3.0%
Local Direct	Sub	440	0	0	0	22	0	22	5.0%
Prime Vendor	Drugs	720720	0	0	0	14414	0	14414	2.0%
Prime Vendor	Med	394624	0	0	0	11839	0	11839	3.0%
Prime Vendor	Sub	40957	0	0	0	2048	0	2048	5.0%
Vend Direct	Drugs	72072	0	0	0	1441	0	1441	2.0%
Vend Direct	Med	30693	0	0	0	921	0	921	3.0%
Vend Direct	Sub	2642	0	0	0	132	0	132	5.0%
Depot VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Depot VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Drugs	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Med	0	0	0	0	0	0	0	0.0%
Local VAMC WH	Sub	0	0	0	0	0	0	0	0.0%
NAC Ovhd	Drugs	0	0	0	0	0	2450	2450	0.0%
NAC Ovhd	Med	0	0	0	0	0	2450	2450	0.0%
NAC Ovhd	Sub	0	0	0	0	0	2450	2450	0.0%
All Channels	Drugs	800800	0	0	0	16016	2450	18466	2.3%
All Channels	Med	438471	0	0	0	13154	2450	15604	3.6%
All Channels	Sub	44040	0	0	0	2202	2450	4652	10.6%
All Channels	All	1283311	0	0	0	31372	7350	38722	3.0%

APPENDIX F

ROAD DISTANCES TO EACH VAMC FROM SUPER DEPOT, REGIONAL DEPOT, AND REGIONAL DISTRIBUTION CENTERS

ROAD DISTANCES TO EACH VAMC FROM SUPER DEPOT, REGIONAL DEPOT, AND REGIONAL DISTRIBUTION CENTERS

Appendix F contains a listing of the Department of Veterans Affairs (VA) Medical Centers (VAMCs) with the locations that our model assigned for serving them in the various cases. For each VAMC shown, there is a corresponding super depot, a corresponding regional depot, and a corresponding regional distribution center (RDC). Also shown are the road distances between the VAMC and those corresponding facilities.

Road Distances to each VAMC from Super Depot, Regional Depots, RDCs

Index	VAMC Location	Super Depot	Miles	Regional Depot	Miles	RDC Location	Miles
1	TOGUS ME	KANSAS CITY MO	1552	SOMERVILLE NJ	390	SOMERVILLE NJ	390
2	WHITE RIV JX VT	KANSAS CITY MO	1360	SOMERVILLE NJ	242	SOMERVILLE NJ	242
3	FT HARRISON MT	KANSAS CITY MO	1204	SEATTLE WA	560	OGDEN UT	388
4	FARGO ND	KANSAS CITY MO	643	CHICAGO IL	667	KANSAS CITY MO	643
5	SIOUX FALLS SD	KANSAS CITY MO	379	CHICAGO IL	555	KANSAS CITY MO	379
6	CHEYENNE WY	KANSAS CITY MO	654	DALLAS TX	838	DENVER CO	113
7	WICHITA KS	KANSAS CITY MO	197	DALLAS TX	390	DALLAS TX	390
8	HONOLULU HI	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0
9	WILMINGTON DE	KANSAS CITY MO	1190	SOMERVILLE NJ	124	SOMERVILLE NJ	124
10	ALBANY NY	KANSAS CITY MO	1304	SOMERVILLE NJ	159	SOMERVILLE NJ	159
11	ALBUQUERQUE NM	KANSAS CITY MO	844	DALLAS TX	684	ALBUQUERQUE NM	0
12	ALEXANDRIA LA	KANSAS CITY MO	648	DALLAS TX	326	DALLAS TX	326
13	ALTOONA PA	KANSAS CITY MO	1011	CHICAGO IL	579	CLEVELAND OH	214
14	AMARILLO TX	KANSAS CITY MO	653	DALLAS TX	348	ALBUQUERQUE NM	342
15	TACOMA WA	KANSAS CITY MO	1763	SEATTLE WA	2	SEATTLE WA	2
16	ANN ARBOR MI	KANSAS CITY MO	754	CHICAGO IL	291	CLEVELAND OH	167
17	DECATUR GA	KANSAS CITY MO	793	ATLANTA GA	0	JACKSONVILLE FL	333
18	AUGUSTA GA	KANSAS CITY MO	939	ATLANTA GA	162	JACKSONVILLE FL	255
19	BALTIMORE MD	KANSAS CITY MO	1132	SOMERVILLE NJ	198	CLEVELAND OH	366
20	BATAVIA NY	KANSAS CITY MO	1009	CHICAGO IL	546	CLEVELAND OH	207
21	BATH NY	KANSAS CITY MO	1171	SOMERVILLE NJ	161	CLEVELAND OH	351
22	BATTLE CREEK MI	KANSAS CITY MO	611	CHICAGO IL	146	CHICAGO IL	146
23	BAY PINES FL	KANSAS CITY MO	1230	ATLANTA GA	496	JACKSONVILLE FL	201
24	BECKLEY WV	KANSAS CITY MO	820	CHICAGO IL	468	CLEVELAND OH	253
25	BEDFORD MA	KANSAS CITY MO	1462	SOMERVILLE NJ	219	SOMERVILLE NJ	219
26	BIG SPRING TX	KANSAS CITY MO	730	DALLAS TX	279	DALLAS TX	279
27	BILOXI MS	KANSAS CITY MO	799	DALLAS TX	524	MEMPHIS TN	416
28	BIRMINGHAM AL	KANSAS CITY MO	679	DALLAS TX	676	MEMPHIS TN	246
29	BONHAM TX	KANSAS CITY MO	516	DALLAS TX	1	DALLAS TX	1
30	BOSTON MA	KANSAS CITY MO	1462	SOMERVILLE NJ	219	SOMERVILLE NJ	219
31	BROCKTON MA	KANSAS CITY MO	1462	SOMERVILLE NJ	219	SOMERVILLE NJ	219
32	BRONX NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
33	BROOKLYN NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
34	BUFFALO NY	KANSAS CITY MO	1009	CHICAGO IL	546	CLEVELAND OH	207
35	BUTLER PA	KANSAS CITY MO	919	CHICAGO IL	492	CLEVELAND OH	140
36	BOISE ID	KANSAS CITY MO	1361	SEATTLE WA	475	OGDEN UT	319
37	CANANDAIGUA NY	KANSAS CITY MO	1084	SOMERVILLE NJ	294	CLEVELAND OH	278
38	CASTLE POINT NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
39	CHARLESTON SC	KANSAS CITY MO	1089	ATLANTA GA	313	JACKSONVILLE FL	235
40	CHICAGO IL	KANSAS CITY MO	481	CHICAGO IL	1	CHICAGO IL	1
41	CHICAGO IL	KANSAS CITY MO	481	CHICAGO IL	1	CHICAGO IL	1
42	CHILLICOTHE OH	KANSAS CITY MO	820	CHICAGO IL	371	CLEVELAND OH	0
43	CINCINNATI OH	KANSAS CITY MO	632	CHICAGO IL	292	CLEVELAND OH	258
44	CLARKSBURG WV	KANSAS CITY MO	895	CHICAGO IL	498	CLEVELAND OH	197
45	CLEVELAND OH	KANSAS CITY MO	820	CHICAGO IL	371	CLEVELAND OH	0
46	COATESVILLE PA	KANSAS CITY MO	1213	SOMERVILLE NJ	95	SOMERVILLE NJ	95
47	COLUMBIA MO	KANSAS CITY MO	149	DALLAS TX	569	CHICAGO IL	366
48	COLUMBIA SC	KANSAS CITY MO	974	ATLANTA GA	228	JACKSONVILLE FL	301
49	MIAMI FL	KANSAS CITY MO	1450	ATLANTA GA	703	JACKSONVILLE FL	378
50	DALLAS TX	KANSAS CITY MO	516	DALLAS TX	1	DALLAS TX	1
51	DANVILLE IL	KANSAS CITY MO	335	CHICAGO IL	149	CHICAGO IL	149
52	DAYTON OH	KANSAS CITY MO	632	CHICAGO IL	292	CLEVELAND OH	258
53	ALLEN PARK MI	KANSAS CITY MO	754	CHICAGO IL	291	CLEVELAND OH	167
54	DENVER CO	KANSAS CITY MO	652	DALLAS TX	764	DENVER CO	0

Road Distances to each VAMC from Super Depot, Regional Depots, RDCs

Index	VAMC Location	Super Depot	Miles	Regional Depot	Miles	RDC Location	Miles
55	DES MOINES IA	KANSAS CITY MO	209	CHICAGO IL	367	CHICAGO IL	367
56	N CHICAGO IL	KANSAS CITY MO	481	CHICAGO IL	1	CHICAGO IL	1
57	DUBLIN GA	KANSAS CITY MO	793	ATLANTA GA	0	JACKSONVILLE FL	333
58	DURHAM NC	KANSAS CITY MO	982	CHICAGO IL	683	CLEVELAND OH	456
59	EAST ORANGE NJ	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
60	ERIE PA	KANSAS CITY MO	926	CHICAGO IL	466	CLEVELAND OH	109
61	FAYETTEVILLE AR	KANSAS CITY MO	305	DALLAS TX	248	DALLAS TX	248
62	FAYETTEVILLE NC	KANSAS CITY MO	982	CHICAGO IL	683	CLEVELAND OH	456
63	FORT HOWARD MD	KANSAS CITY MO	1132	SOMERVILLE NJ	198	CLEVELAND OH	366
64	FT. LYON CO	KANSAS CITY MO	652	DALLAS TX	764	DENVER CO	0
65	FORT MEADE SD	KANSAS CITY MO	658	DALLAS TX	986	DENVER CO	370
66	FORT WAYNE IN	KANSAS CITY MO	605	CHICAGO IL	166	CHICAGO IL	166
67	FRESNO CA	KANSAS CITY MO	1616	LOS ANGELES CA	236	LOS ANGELES CA	236
68	GAINESVILLE FL	KANSAS CITY MO	1114	ATLANTA GA	334	JACKSONVILLE FL	0
69	GRAND ISLAND NE	KANSAS CITY MO	417	DALLAS TX	708	DENVER CO	283
70	GRAND JXN CO	KANSAS CITY MO	877	DALLAS TX	913	ALBUQUERQUE NM	344
71	HINES IL	KANSAS CITY MO	481	CHICAGO IL	1	CHICAGO IL	1
72	HOT SPRINGS SD	KANSAS CITY MO	658	DALLAS TX	986	DENVER CO	370
73	HOUSTON TX	KANSAS CITY MO	757	DALLAS TX	276	DALLAS TX	276
74	HUNTINGTON WV	KANSAS CITY MO	820	CHICAGO IL	468	CLEVELAND OH	253
75	INDIANAPOLIS IN	KANSAS CITY MO	530	CHICAGO IL	192	CHICAGO IL	192
76	IOWA CITY IA	KANSAS CITY MO	294	CHICAGO IL	242	CHICAGO IL	242
77	IRON MTN MI	KANSAS CITY MO	667	CHICAGO IL	322	CHICAGO IL	322
78	JACKSON MS	KANSAS CITY MO	621	DALLAS TX	454	MEMPHIS TN	226
79	KANSAS CITY MO	KANSAS CITY MO	0	DALLAS TX	516	KANSAS CITY MO	0
80	HAMPTON VA	KANSAS CITY MO	1181	SOMERVILLE NJ	345	SOMERVILLE NJ	345
81	KERRVILLE TX	KANSAS CITY MO	812	DALLAS TX	297	DALLAS TX	297
82	KNOXVILLE IA	KANSAS CITY MO	209	CHICAGO IL	367	CHICAGO IL	367
83	LAKE CITY FL	KANSAS CITY MO	1114	ATLANTA GA	334	JACKSONVILLE FL	0
84	LEBANON PA	KANSAS CITY MO	1106	SOMERVILLE NJ	180	CLEVELAND OH	310
85	LEXINGTON KY	KANSAS CITY MO	644	CHICAGO IL	364	CLEVELAND OH	328
86	LINCOLN NE	KANSAS CITY MO	191	DALLAS TX	667	KANSAS CITY MO	191
87	LITTLE ROCK AR	KANSAS CITY MO	383	DALLAS TX	331	DALLAS TX	331
88	LIVERMORE CA	KANSAS CITY MO	1750	LOS ANGELES CA	391	LOS ANGELES CA	391
89	LONG BEACH CA	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0
90	LOUISVILLE KY	KANSAS CITY MO	555	CHICAGO IL	313	CHICAGO IL	313
91	LYONS NJ	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
92	LOMA LINDA CA	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0
93	MADISON WI	KANSAS CITY MO	450	CHICAGO IL	143	CHICAGO IL	143
94	MANCHESTER NH	KANSAS CITY MO	1443	SOMERVILLE NJ	238	SOMERVILLE NJ	238
95	MARION IL	KANSAS CITY MO	414	DALLAS TX	633	CHICAGO IL	392
96	MARION IN	KANSAS CITY MO	530	CHICAGO IL	192	CHICAGO IL	192
97	MARLIN TX	KANSAS CITY MO	635	DALLAS TX	118	DALLAS TX	118
98	MARTINEZ CA	KANSAS CITY MO	1750	LOS ANGELES CA	391	LOS ANGELES CA	391
99	MARTINSBURG WV	KANSAS CITY MO	990	CHICAGO IL	577	CLEVELAND OH	232
100	MEMPHIS TN	KANSAS CITY MO	441	DALLAS TX	489	MEMPHIS TN	0
101	MILES CITY MT	KANSAS CITY MO	1005	SEATTLE WA	769	OGDEN UT	426
102	MINNEAPOLIS MN	KANSAS CITY MO	478	CHICAGO IL	411	CHICAGO IL	411
103	MONTGOMERY AL	KANSAS CITY MO	771	DALLAS TX	717	MEMPHIS TN	331
104	MONTROSE NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
105	MTN HOME TN	KANSAS CITY MO	797	CHICAGO IL	535	CLEVELAND OH	403
106	MURFREESBORO TN	KANSAS CITY MO	555	DALLAS TX	716	MEMPHIS TN	227
107	MUSKOGEE OK	KANSAS CITY MO	350	DALLAS TX	207	DALLAS TX	207
108	NASHVILLE TN	KANSAS CITY MO	555	DALLAS TX	716	MEMPHIS TN	227

Road Distances to each VAMC from Super Depot, Regional Depots, RDCs

Index	VAMC Location	Super Depot	Miles	Regional Depot	Miles	RDC Location	Miles
109	NEWINGTON CT	KANSAS CITY MO	1363	SOMERVILLE NJ	116	SOMERVILLE NJ	116
110	NEW ORLEANS LA	KANSAS CITY MO	799	DALLAS TX	524	MEMPHIS TN	416
111	NEW YORK NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
112	NORTHAMPTON MA	KANSAS CITY MO	1363	SOMERVILLE NJ	116	SOMERVILLE NJ	116
113	NORTHPORT NY	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
114	OKLA CITY OK	KANSAS CITY MO	350	DALLAS TX	207	DALLAS TX	207
115	OMAHA NE	KANSAS CITY MO	191	DALLAS TX	667	KANSAS CITY MO	191
116	ASHEVILLE NC	KANSAS CITY MO	941	ATLANTA GA	265	JACKSONVILLE FL	399
117	PALO ALTO CA	KANSAS CITY MO	1750	LOS ANGELES CA	391	LOS ANGELES CA	391
118	PERRY POINT MD	KANSAS CITY MO	1190	SOMERVILLE NJ	124	SOMERVILLE NJ	124
119	PHILADELPHIA PA	KANSAS CITY MO	1213	SOMERVILLE NJ	95	SOMERVILLE NJ	95
120	PHOENIX AZ	KANSAS CITY MO	1227	LOS ANGELES CA	426	ALBUQUERQUE NM	385
121	PITTSBURGH PA	KANSAS CITY MO	919	CHICAGO IL	492	CLEVELAND OH	140
122	PITTSBURGH PA	KANSAS CITY MO	919	CHICAGO IL	492	CLEVELAND OH	140
123	POPLAR BLUFF MO	KANSAS CITY MO	327	DALLAS TX	523	MEMPHIS TN	137
124	PORTLAND OR	KANSAS CITY MO	1751	SEATTLE WA	176	SEATTLE WA	176
125	PRESCOTT AZ	KANSAS CITY MO	1227	LOS ANGELES CA	426	ALBUQUERQUE NM	385
126	PROVIDENCE RI	KANSAS CITY MO	1440	SOMERVILLE NJ	180	SOMERVILLE NJ	180
127	RICHMOND VA	KANSAS CITY MO	1094	SOMERVILLE NJ	336	SOMERVILLE NJ	336
128	ROSEBURG OR	KANSAS CITY MO	1751	SEATTLE WA	176	SEATTLE WA	176
129	RENO NV	KANSAS CITY MO	1577	LOS ANGELES CA	450	LOS ANGELES CA	450
130	SAGINAW MI	KANSAS CITY MO	742	CHICAGO IL	278	CLEVELAND OH	250
131	ST. CLOUD MN	KANSAS CITY MO	478	CHICAGO IL	411	CHICAGO IL	411
132	ST LOUIS MO	KANSAS CITY MO	279	CHICAGO IL	303	CHICAGO IL	303
133	SALEM VA	KANSAS CITY MO	942	CHICAGO IL	607	CLEVELAND OH	357
134	SALISBURY NC	KANSAS CITY MO	941	ATLANTA GA	265	JACKSONVILLE FL	399
135	SALT LAKE UT	KANSAS CITY MO	1088	LOS ANGELES CA	709	OGDEN UT	0
136	SAN FRAN CA	KANSAS CITY MO	1750	LOS ANGELES CA	391	LOS ANGELES CA	391
137	SEATTLE WA	KANSAS CITY MO	1763	SEATTLE WA	2	SEATTLE WA	2
138	SAN DIEGO CA	KANSAS CITY MO	1561	LOS ANGELES CA	148	LOS ANGELES CA	148
139	SEPULVEDA CA	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0
140	SHERIDAN WY	KANSAS CITY MO	875	SEATTLE WA	891	OGDEN UT	414
141	SHREVEPORT LA	KANSAS CITY MO	540	DALLAS TX	210	DALLAS TX	210
142	SPOKANE WA	KANSAS CITY MO	1505	SEATTLE WA	268	SEATTLE WA	268
143	SYRACUSE NY	KANSAS CITY MO	1170	SOMERVILLE NJ	228	CLEVELAND OH	354
144	SAN ANTONIO TX	KANSAS CITY MO	812	DALLAS TX	297	DALLAS TX	297
145	SAN JUAN PR	KANSAS CITY MO	1283	SOMERVILLE NJ	0	SOMERVILLE NJ	0
146	TAMPA FL	KANSAS CITY MO	1230	ATLANTA GA	496	JACKSONVILLE FL	201
147	TEMPLE TX	KANSAS CITY MO	635	DALLAS TX	118	DALLAS TX	118
148	TOMAH WI	KANSAS CITY MO	431	CHICAGO IL	266	CHICAGO IL	266
149	TOPEKA KS	KANSAS CITY MO	0	DALLAS TX	516	KANSAS CITY MO	0
150	TUCSON AZ	KANSAS CITY MO	1227	LOS ANGELES CA	426	ALBUQUERQUE NM	385
151	TUSCALOOSA AL	KANSAS CITY MO	679	DALLAS TX	676	MEMPHIS TN	246
152	TUSKEGEE AL	KANSAS CITY MO	771	DALLAS TX	717	MEMPHIS TN	331
153	WACO TX	KANSAS CITY MO	635	DALLAS TX	118	DALLAS TX	118
154	LEAVENWORTH KS	KANSAS CITY MO	0	DALLAS TX	516	KANSAS CITY MO	0
155	WALLA WALLA WA	KANSAS CITY MO	1518	SEATTLE WA	255	SEATTLE WA	255
156	WASHINGTON DC	KANSAS CITY MO	1105	SOMERVILLE NJ	238	CLEVELAND OH	357
157	WEST HAVEN CT	KANSAS CITY MO	1348	SOMERVILLE NJ	81	SOMERVILLE NJ	81
158	LOS ANGELES CA	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0
159	WHITE CITY OR	KANSAS CITY MO	1682	SEATTLE WA	439	SEATTLE WA	439
160	WILKES-BARRE PA	KANSAS CITY MO	1166	SOMERVILLE NJ	124	CLEVELAND OH	350
161	MILWAUKEE WI	KANSAS CITY MO	516	CHICAGO IL	105	CHICAGO IL	105
162	LOS ANGELES CA	KANSAS CITY MO	1595	LOS ANGELES CA	0	LOS ANGELES CA	0

Road Distances to each VAMC from Super Depot, Regional Depots, RDCs

Index	VAMC Location	Super Depot	Miles	Regional Depot	Miles	RDC Location	Miles
163	EL PASO TX	KANSAS CITY MO	984	DALLAS TX	671	ALBUQUERQUE NM	270
164	COLUMBUS OH	KANSAS CITY MO	726	CHICAGO IL	323	CLEVELAND OH	147
165	LAS VEGAS NV	KANSAS CITY MO	1336	LOS ANGELES CA	274	LOS ANGELES CA	274

APPENDIX G

DEPOT MECHANIZATION

DEPOT MECHANIZATION

Before completing our analysis of distribution network alternatives, we were asked by the Office of Acquisition and Material Management (OA&MM) to advise them on whether mechanization was appropriate for the existing Department of Veterans Affairs (VA) supply depots. We examined the opportunities for such mechanization based on the understanding that VA was looking for projects with quick payback that might be justified on short-term improvement assuming that the depots would be in business for at least 2 years no matter what distribution network alternative is chosen. We delivered a letter report to OA&MM on June 5, 1992. This appendix contains that report.

LMI LOGISTICS MANAGEMENT INSTITUTE
6400 GOLDSBORO ROAD, BETHESDA, MARYLAND 20817-5886 (301) 320-2000

5 June 1992

Mr. H. Robert Saldivar
Deputy Assistant Secretary
for Acquisition and Material Management
Department of Veterans Affairs
Washington, DC 20420

Dear Mr. Saldivar:

Under LMI task order VA201, we have analyzed mechanization opportunities for the current warehouse operations at the Bell, Hines, and Somerville depots. While our final report will identify mechanization possibilities for future alternative distribution systems, we believe it is appropriate to appraise you of improvements that can be pursued in the near term. Your staff has expressed considerable interest in this effort. The enclosed letter report describes our findings, conclusions, and recommendations for the current depots in the near term.

Sincerely,

Samuel J. Mallette

Samuel J. Mallette

pgl

Enclosure

MECHANIZATION OPPORTUNITIES FOR VA SUPPLY DEPOTS

The methodology we used to identify and analyze mechanization opportunities was to first visit all three depots and obtain information about their mission and operating procedures. Based on these visits, we formed some general observations about the depots. We then identified several possible mechanization improvements. We combined our general observations about the VA depots with specific information provided to us by depot personnel to determine which of these improvements were infeasible, which could be pursued immediately, and which would require some financial analysis. Of the ones requiring financial analysis, we compared three combinations of improvements to the technology currently existing at the depots to determine which offers the greatest potential for savings.

DEPOT OBSERVATIONS

We visited each of the depots to understand their operating environment and specific characteristics. Personnel at each depot provided us with workload, productivity, space utilization, and other relevant data. In general the depots are operating in an environment that is undergoing considerable change with the implementation of the ISMS and USXPRESS programs. In addition, the prime vendor program is perceived by depot personnel as a competitive threat. As such, the depot managers and supervisors are beginning to explore available technologies existing in the private sector in an effort to remain as competitive as possible. Specifically, we observed that:

- Each of the depots ship relatively low volumes of material. Average daily volume per depot ranges from 560 lines per day at the Bell depot to 1,400 lines per day at the Hines depot.
- The depots have relatively low direct labor costs. While each of the operations is almost entirely manual, there are 22, 36, and 42 direct employees at Bell, Somerville, and Hines respectively. Pick rates average 50 lines per hour for loose issue, and 20 lines per hour for bulk issue.
- The depots are relatively well organized in terms of location management, material flow, and information flow. There are, however, some opportunities for process improvements in these areas.

- Overhead cost is relatively high at the Hines depot. There are 80 full time equivalents (FTE) at Hines expended on depot support activities. This is almost twice the amount of direct labor employees at that site.

- Each of the depots handles three very different commodity groups in terms of size and value. The pharmaceutical items are relatively small in size and relatively expensive. The medical supplies are much larger in size and are moderately expensive. The subsistence items are also large in size, but are fairly inexpensive. The cost of handling items through the depot system is approximately 4 percent, 14 percent, and 29 percent of purchase cost for pharmaceutical items, medical supplies, and subsistence items respectively.

- The near future will bring a vastly different ordering pattern to the depots. With the advent of USXPRESS and similar types of programs for medical supplies and subsistence, customers will order fewer items more frequently. In order to prevent a rapid increase in employment, depot management will be forced to change their pick strategies, utilizing order batching and increased picking from forward pick areas.

- The amount of loose issue versus bulk issue for each commodity group will dictate the amounts and kinds of storage technology that should be employed.

- The supply patterns for material arriving at the depots is likely to change. Items will be ordered more frequently and inventories will be lower. These revised ordering policies will affect storage space requirements.

- The private sector is very cost competitive in all three commodity groups. Because private companies experience much larger volumes in much more concentrated geographical areas than VA experiences, they can take advantage of economies of scale. It will be difficult for the VA supply depots to maintain cost-effective operations: their future is uncertain.

The relatively low volumes and low amounts of direct labor make the supply depots poor candidates for *extensive* automation because the potential savings that these projects would generate are relatively small in comparison to the several million dollars that would be spent on them. The uncertain future of the depots in terms of both future supply, storage, and demand patterns and in terms of competition from the private sector make the mechanization planning task difficult. Any mechanized solution must have a relatively short implementation time period, must pay off quickly, and must be flexible.

MECHANIZATION OPPORTUNITIES

Using our knowledge of the depot operations and our knowledge of existing technologies, we identified several possible opportunities for improvement at the depots. Table 1 shows a list of possible improvements broken down into three broad categories: manual improvements, semi-automated improvements, and fully-automated improvements. Manual improvements center around changing the processes, not the technology. The work remains largely labor intensive, and the costs of these improvements are small. Semi-automated improvements involve making the workforce more productive by reducing or eliminating costly travel time associated with getting the worker to the material. In a manual pick operation, travel time may consume as much as 70 percent of the total pick time, so the benefits to eliminating travel time are large. The costs of semi-automated improvements are between $100,000 and $1,000,000. Fully automated improvements take the process a step further by also eliminating the actual pick and stow activity performed by the warehouse employee. The costs of these types of systems can run well into the millions of dollars.

After some preliminary analysis, we judged some of the improvements initially identified to be infeasible. Table 2 shows a list of the improvements that we consider infeasible and the reasons why. Because of the high cost, the relatively low potential for savings, and the short financial horizon, we considered all fully-automated improvements to be infeasible for the VA supply depots. When one considers that a small automated item or order picking system could easily cost $2 million, and the potential savings might optimistically be 10 employees at $29,750[1] per year it becomes clear that this kind of technology is simply not financially appropriate. We also ruled out some of the semi-automated improvements as being either too costly or not appropriate for the items stocked in the depots.

[1]$29,750 represents a warehouse worker earning $25,000 annually with 19 percent added for benefits. This equates to an average wage rate of $15.50 per hour with benefits.

TABLE 1

COMPARISON OF MECHANIZATION IMPROVEMENT GROUPS

	Manual improvements	Semi-automated improvements	Fully-automated improvements
Cost	Low ($00,000)	Medium ($000,000)	High ($0,000,000)
Types of improvements	Process improvements	Man-to-material systems	Complete automation
	Modifications to current system	Material-to-man systems	
Possible technologies	Shelving and racks	Case conveyance equipment	Mechanized case picking
	Flow racks	Loose conveyance equipment	Mechanized loose picking
	Trucks with "trains"	Horizontal carousels	Sortation equipment
	Zone picking strategies	Vertical storage and retrieval	
	Batch picking strategies	Wire guidance	
	Direct truck loading	Computer assisted flow racks	
	Forward picking strategies	Automatic storage & retrieval systems	
	Re-warehousing strategies		
	Eliminate dual inventories		
	Streamline receipt processing		

TABLE 2

VA SUPPLY DEPOT INFEASIBLE IMPROVEMENTS

Improvement	Reason for infeasibility
Mechanized case picking	Not financially justifiable.
Mechanized loose picking	Not financially justifiable.
Sortation equipment	Not financially justifiable.
Case conveyance equipment	Extra material handling required in manual operation. Also costly in comparison to savings generated.
Vertical storage and retrieval	Not enough ceiling height to make cost effective. Horizontal carousels cost less per cubic foot of storage.
Wire guidance	Not necessary for bulk floor storage. Works well with racks but most of material will not be stored in racks because of bulk.
Computer assisted flow racks	Not significantly different from regular flow racks.
Automatic storage and retrieval system	Cycle times are slow and systems are costly. Financial justification unlikely.

There are a number of improvements that can be made immediately. These require little or no financial commitment and are appropriate under almost any circumstances that the depots will experience. They are shown in Table 3. They are all process improvements as opposed to equipment improvements and will yield a net savings of labor hours when carried out.

For the remaining improvements (i.e., those not categorized as either infeasible or immediate), we formulated three possible combinations of alternatives that could be financially modeled. All three alternatives center around forward picking areas containing loose issue items. With the exception of the loose issue storage and retrieval technology used, each of the alternatives is identical. They are, however, considerably different than the baseline. Table 4 shows a list of the technologies employed in each of the alternatives as compared to the current system (baseline).

TABLE 3

VA SUPPLY DEPOT IMMEDIATE IMPROVEMENTS

Improvement	Reason for implementation
Direct truck loading	Eliminate extra material handling associated with staging material. Also to speed up overall order processing time at the depots.
Re-warehousing strategy and periodic review	By developing strategy for locating items within warehouse and periodically reviewing assigned locations, pick time, and location utilization will improve.
Eliminate dual inventories of FASTRAC and regular item stocks	Will eliminate costly material handling and paperwork processing. Will also give increased flexibility of inventory and storage space.
Streamline receipt processing	Current system requires many redundant pieces of information be entered when receiving material. This can be eliminated.

We envision each of the three alternatives accommodating three key procedural changes to the present system: larger amounts of forward picking, an order batching technique to speed up order picking, and a modified zone picking strategy. The alternatives are flexible enough to accommodate up to 70 percent of total workload in the forward pick areas. Those areas should be replenished, on average, twice per week (less frequently and with larger quantities than now). Orders would be batched and picked together by one picker in a particular zone. The picker would be responsible for sorting his own orders. In the loose issue area, we envision that batches of orders would be picked sequentially. That is, each batch would be filled with items picked from one zone, then passed to the next zone where additional items would be added. In the case lot area, batches would be picked simultaneously. Loose issue and case lot picks will then be married together when all picking is complete for a batch.

FINANCIAL ANALYSIS

We used discounted cash flow analysis to compare the three alternatives. We analyzed each of the alternatives under an environment where customers order all commodity groups through a USXPRESS type of program. This means that medical

TABLE 4

VA SUPPLY DEPOT IMPROVEMENT ALTERNATIVES REQUIRING ANALYSIS

	Baseline	Alternative 1	Alternative 2	Alternative 3
Forward pick storage (loose)	Static shelving	Static shelving	Gravity flow racks	Horizontal carousels
Small item conveyance	Little or no conveyance	Loose item conveyance	Loose item conveyance	Loose item conveyance
Case material handling	Fork trucks or reach trucks	Trucks with trains	Trucks with trains	Trucks with trains
Bulk storage	Floor storage of bulk items	Floor storage of bulk items	Floor storage of bulk items	Floor storage of bulk items
Pick method (A)	Pick by order	Batch Picking	Batch picking	Batch picking
Pick method (B)	Simultaneous zone picking	Sequential and simul-taneous zone picking	Sequential and simul-taneous zone picking	Sequential and simul-taneous zone picking
Amount stored in forward area	Negligible amount	Two to three day supply	Two to three day supply	Two to three day supply

centers would be ordering material several times per month rather than once a month as is currently the case. We compared each of the alternatives in this environment to the current operation or baseline. We actually considered two baselines; one under the 30 day ordering scenario (baseline) and another under the USXPRESS scenario (modified baseline).

Table 5 shows the results of the financial analysis. The modified baseline figures indicate what will happen at the depots if no changes are made to existing technologies or processes and a USXPRESS ordering environment is fully implemented in all commodity groups. The operations will require 28 additional FTE. The cost of such a change will be in excess of $800,000 per year in additional labor dollars.

Table 5 shows that all three of the alternatives are favorable. The calculated net present value, discounted payback periods, and discounted rates of return are computed by comparing the alternatives to the modified baseline which represents

what the supply depots will experience if none of the alternatives is selected.[2] All of the alternatives have high discounted rates of return, high net present values, and low discounted payback periods. Alternatives 1, 2, and 3 require 16, 14, and 11 additional FTE respectively over the baseline. Alternative 3 has a drawback in that it requires some skill in implementation and maintenance of software because it requires computerized control of horizontal carousels to achieve its expected benefits.

Because our data is subject to some degree of error, we conducted sensitivity analysis on the financial results. In our sensitivity analysis, we examined both a worst case scenario and a best case scenario. Table 6 summarizes the results of that sensitivity analysis. The results show that implementing a USXPRESS type of program for all commodity groups without changing technologies or processes will result in the need for an increase of between 11 and 51 FTE. By pursuing Alternative 1, the requirement changes to between 11 and 24 additional FTE. For Alternative 2, the need is for between 6 and 24 additional FTE, and for Alternative 3, the need is for between 3 and 20 additional FTE.

The financial comparison to the modified baseline shows favorable results in the worst case for Alternatives 1 and 2. Each of these alternatives will pay for itself in less than two years and will provide a discounted rate of return in excess of 16 percent. They both will have positive net present values. Alternative 3 does not show favorable results in the worst case: it has a discounted payback period greater than two years, a negative net present value, and a negative discounted rate of return. The data used for the financial and sensitivity analyses are summarized in Table 7.

[2]The net present value and discounted payback period calculations use a 10 percent opportunity cost rate. The net present value and discounted rate of return calculations use a two year financial planning horizon.

TABLE 5

VA SUPPLY DEPOT IMPROVEMENTS FINANCIAL ANALYSIS

(Expected Results)

Component	Baseline	Modified baseline	Alternative 1	Alternative 2	Alternative 3
Customer ordering environment	30 Day	USXPRESS	USXPRESS	USXPRESS	USXPRESS
Level of complexity	None	None	None	Small	Medium
Equipment cost					
Flow racks				$112,500	
Carousels					$480,000
Conveyance equipment				$18,750	
Other			$30,000	$30,000	$30,000
Total cost (all locations)	$0	$0	$30,000	$161,250	$510,000
Workload (transactions)					
Loose pick	18,247	107,999	107,999	107,999	107,999
Bulk pick - pharmaceuticals	12,325	25,825	25,825	25,825	25,825
Bulk pick - medical supplies	15,286	32,028	32,028	32,028	32,028
Bulk pick - subsistence	14,561	30,509	30,509	30,509	30,509
Loose replenishment	8,393	49,680	10,143	10,143	10,143
Productivity (lines per hour)					
Loose pick	50	50	60	75	120
Bulk pick - pharmaceuticals	20	30	30	30	30
Bulk pick - medical supplies	14	21	21	21	21
Bulk pick - subsistence	14	21	21	21	21
Loose replenishment	25	25	25	25	25
Total pick hours required	3,449	7,986	6,045	5,685	5,145
Annualized savings					
Dollars – over baseline		($843,903)	($482,792)	($415,832)	($315,393)
Dollars – over modified baseline			$361,111	$428,070	$528,509
FTE – over baseline		– 28.4	– 16.2	– 14.0	– 10.6
FTE – over modified baseline			12.1	14.4	17.8
Justification					
Net present value			$596,722	$581,682	$407,248
Discounted payback (years)			0.1	0.4	1.1
Discounted rate of return			1196.5%	242.9%	66.0%

TABLE 6

VA SUPPLY DEPOT IMPROVEMENTS SENSITIVITY ANALYSIS

Component	Modified baseline	Alternative 1	Alternative 2	Alternative 3
ANNUALIZED SAVINGS				
Dollars – over baseline				
Worst case	($1,505,136)	($701,015)	($701,015)	($601,123)
Expected	($843,903)	($482,792)	($415,832)	($315,393)
Best case	($337,606)	($315,570)	($180,715)	($75,827)
Dollars – over modified baseline				
Worst case		132,699	$132,699	$232,592
Expected		361,111	$428,070	$528,509
Best case		620,365	$755,220	$860,107
FTE – over baseline				
Worst case	-50.6	-23.6	-23.6	-20.2
Expected	-28.4	-16.2	-14.0	-10.6
Best case	-11.3	-10.6	-6.1	-2.5
FTE – over modified baseline				
Worst case		4.5	4.5	7.8
Expected		12.1	14.4	17.8
Best case		20.8	25.4	28.9
JUSTIFICATION				
Net present value				
Worst case		185,305	$19,055	($206,328)
Expected		596,722	$581,682	$407,248
Best case		1,061,666	$1,199,462	$1,082,748
Discounted payback (years)				
Worst case		0.4	1.8	3.2
Expected		0.1	0.4	1.1
Best case		0.0	0.2	0.5
Discounted rate of return				
Worst case		273.8%	16.7%	-16.3%
Expected		1196.5%	242.9%	66.0
Best case		4133.5%	667.3%	183.7

TABLE 7

VA SUPPLY DEPOT IMPROVEMENTS FINANCIAL ANALYSIS PARAMETERS

Component	All cases	Worst case	Expected case	Best case
Current data				
Items – pharmacy	744			
Items – medical	383			
Items – subsistence	223			
Monthly lines	60,419			
Percent loose	30.2%			
Percent bulk drug	20.4%			
Percent bulk medical supplies	25.3%			
Percent bulk subsistence	24.1%			
Replenishment rate	46.0%			
Productivity – loose	50			
Productivity – bulk pharmaceuticals	20			
Productivity – bulk medical supplies	14			
Productivity – bulk subsistence	14			
Productivity – replenishment	20			
USXPRESS changes[a]				
Percent loose		40%	55%	70%
Line expansion factor		250%	325%	400%
Improvements/changes under USXPRESS environment				
Productivity – loose		50	50	50
Productivity – bulk drug		20	30	40
Productivity – bulk medical supplies		16	21	26
Productivity – bulk subsistence		16	21	26
Productivity – replenishment		20	25	30
Productivity – Alternative 1 loose		50	60	70
Productivity – Alternative 2 loose		50	75	100
Productivity – Alternative 3 loose		90	120	150
Replenishments per month		12	9	6
Cost				
Alternative 1		$45,000	$30,000	$15,000
Alternative 2		211,250	$161,250	$111,250
Alternative 3		610,000	$510,000	$410,000
Other				
Hourly wage rate	$15.50			
Opportunity cost rate	10%			
Financial horizon (years)	2			

[a]For comparison of modified baseline to baseline, worst case and best case figures for USXPRESS changes were reversed.

CONCLUSIONS

Based on our mechanization analysis of the VA supply depots, we have concluded that:

- Extensive automation is not appropriate at the depots because the benefits do not justify the costs. The benefits are small because workload volumes are relatively low. Also, because of the uncertain future of the depots, the financial planning horizon must be short.
- The depots will experience tremendous workload increases if a USXPRESS type of program is fully implemented for all of the commodity groups. The financial analysis showed that manpower must increase by 25 FTE.
- The effects of the increased workload that a USXPRESS type of program will cause can be mitigated by batching orders and by storing far greater amounts of material in forward pick areas, regardless of the type of storage technology employed.
- Alternative 2 is superior to the other alternatives examined in the financial analysis, even though all of the alternatives are financially attractive. It is more desirable than Alternative 3 because it can be implemented quickly, requires no new computer systems or interfaces, and is more attractive in the worst case scenario. It is superior to Alternative 1 because it requires fewer FTE to operate: in this time of uncertainty it makes sense to minimize the number of FTE added to accommodate the USXPRESS scenario for all commodity groups.
- Several process improvements can be made at the depots to free up labor resources.

RECOMMENDATIONS

Based on our conclusions, we recommend that in the near term the VA supply depots:

- Use an order batching scheme to pick all USXPRESS types of orders, including items to be picked in case lots.
- Transform loose issue pick areas into one or two forward pick areas containing most pharmaceutical items and most medical supplies. The technology employed should be gravity flow racks and should contain gravity roller conveyors in the aisles to assist the pickers in moving rapidly through them. Less-than-case lots should be picked from the forward pick areas and case lots directly from the bulk storage areas. The forward pick areas should hold a minimum of one half week's supply of each item.

- Implement a direct truck loading scheme for full-truckload shipments. This will entail eliminating the staging of material prior to shipment and will require that the advanced shipment planning capability in ISMS be utilized. Once items are picked for a particular order, they should be loaded onto the appropriate truck.

- Implement a periodic or continuous re-warehousing strategy. This strategy should consist of placing relatively high movement items in one or a few areas to reduce order picking travel time. It should also serve to consolidate like items in one or a few locations and to move items to locations of the appropriate size for that item, considering current usage.

- Eliminate dual inventories of regular loose issue and FASTRAC loose issue items. This will eliminate both paperwork handling time and material handling time and will yield increased flexibility of both inventory and storage space. The on-line capability of ISMS should eliminate the need for two separate systems.

- Streamline the receiving process by eliminating the computer entry of already known information such as cost or number of units in outer pack. The ability of ISMS to communicate directly with the IFCAP system should facilitate this change.

The depot staff should continuously look for improvements by keeping up with current technologies and by making visits to other warehouse operations. The ISMS system will provide them with capabilities they have never had, including a real-time inventory system, location management capability, shipment planning capability, and support for forward pick areas. As this capability is achieved, as more technology becomes available at lower prices, and as the future of the depots becomes clearer, more mechanization alternatives may make sense.